Y 3. At 7 : 16/18-15

AUG 31 1964

AUG 31 1964

NUCLEAR SCIENCE ABSTRACTS

Volume 18 Number 15

Abstracts 25037–27001

MIAMI UNIVERSITY LIBRARY

August 15, 1964

UNITED STATES ATOMIC ENERGY COMMISSION
Division of Technical Information

USAEC DEPOSITORY LIBRARIES

Collections of USAEC reports are maintained in the libraries of the organizations listed below for reference use by the general public. Facilities for making photocopies are available. The USAEC also makes available through these libraries atomic energy reports of countries other than the U. S. that are abstracted in *Nuclear Science Abstracts*.

ALABAMA
Auburn, Auburn University
Birmingham, Public Library

ARIZONA
Tucson, University of Arizona

ARKANSAS
Fayetteville, University of Arkansas

CALIFORNIA
Berkeley, University of California
Davis, University of California
Los Angeles, University of California
Menlo Park, Stanford Research Institute
San Diego, Public Library

COLORADO
Boulder, University of Colorado
Denver, Public Library

CONNECTICUT
New Haven, Yale University

DELAWARE
Newark, University of Delaware

DISTRICT OF COLUMBIA
Washington, Library of Congress

FLORIDA
Coral Gables, University of Miami
Gainesville, University of Florida

GEORGIA
Atlanta, Georgia Institute of Technology

HAWAII
Honolulu, University of Hawaii

ILLINOIS
Chicago, John Crerar Library
Chicago, University of Chicago
Evanston, Northwestern University
Urbana, University of Illinois

INDIANA
Indianapolis, Public Library
Lafayette, Purdue University

IOWA
Ames, Iowa State University

KANSAS
Manhattan, Kansas State University

KENTUCKY
Lexington, University of Kentucky
Louisville, University of Louisville

LOUISIANA
Baton Rouge, Louisiana State University
New Orleans, Tulane University

MARYLAND
Baltimore, Johns Hopkins University
College Park, University of Maryland

MASSACHUSETTS
Cambridge, Harvard University
Cambridge, Massachusetts Institute of Technology

MICHIGAN
Ann Arbor, University of Michigan
Detroit, Public Library
East Lansing, Michigan State University

MINNESOTA
Minneapolis, University of Minnesota

MISSOURI
Kansas City, Linda Hall Library
Rolla, University of Missouri School of Mines and Metallurgy
St. Louis, Washington University

MONTANA
Bozeman, Montana State College

NEVADA
Las Vegas, Nevada Southern University
Reno, University of Nevada

NEW JERSEY
Princeton, Princeton University
Teaneck, Fairleigh Dickinson University

NEW MEXICO
Albuquerque, University of New Mexico

NEW YORK
Albany, The University of the State of New York
Buffalo, State University of New York at Buffalo
Ithaca, Cornell University
New York, Atomic Industrial Forum, Inc.
New York, Columbia University
New York, New York University
Rochester, University of Rochester
Schenectady, Union College
Syracuse, Syracuse University
Troy, Rensselaer Polytechnic Institute

NORTH CAROLINA
Charlotte, Public Library of Charlotte and Mecklenburg County
Durham, Duke University
Raleigh, North Carolina State College

NORTH DAKOTA
Grand Forks, University of North Dakota

OHIO
Cincinnati, University of Cincinnati
Cleveland, Public Library

OHIO (CONT.)
Columbus, Ohio State University
Toledo, University of Toledo
Youngstown, Youngstown University

OKLAHOMA
Norman, University of Oklahoma
Stillwater, Oklahoma State University

OREGON
Corvallis, Oregon State University
Portland, Reed College

PENNSYLVANIA
Philadelphia, University of Pennsylvania
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University

PUERTO RICO
Rio Piedras, University of Puerto Rico

RHODE ISLAND
Providence, Brown University

SOUTH CAROLINA
Columbia, University of South Carolina

TENNESSEE
Knoxville, University of Tennesse
Memphis, Public Library
Nashville, Joint University Libraries
Oak Ridge, Oak Ridge Institute of Nuclear Studies

TEXAS
Austin, University of Texas
College Station, Texas A & M University
Dallas, Southern Methodist University
Houston, Rice University
Lubbock, Texas Technological College
San Antonio, Public Library

UTAH
Salt Lake City, University of Utah

VIRGINIA
Blacksburg, Virginia Polytechnic Institute
Charlottesville, University of Virginia
Norfolk, Old Dominion College

WASHINGTON
Pullman, Washington State University
Seattle, University of Washington

WEST VIRGINIA
Morgantown, West Virginia University

WISCONSIN
Madison, University of Wisconsin
Milwaukee, Public Library

WYOMING
Laramie, University of Wyoming

Volume 18, Number 15, August 15, 1964

NUCLEAR SCIENCE ABSTRACTS

A semimonthly publication of the USAEC Division of Technical Information, Edward J. Brunenkant, Director.
Published by the USAEC Division of Technical Information Extension, Robert L. Shannon, Extension Manager.

Nuclear Science Abstracts covers the international literature on nuclear science and technology and provides the only comprehensive abstracting and indexing of this body of information. Published twice each month since 1947, *NSA* covers technical reports of the U. S. Atomic Energy Commission and its contractors, technical reports of U. S. Government agencies and other governments, universities, industrial and research organizations, as well as patents, books, and journal literature on a world-wide basis. More than 250,000 abstracts have appeared in *NSA* through Volume 17. The subject matter covered in *NSA* is described in detail in Report TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37831.

Abstracts are arranged according to a number of subject categories and subcategories. Definitions of categories appear in Issues No. 1 and 13. If the language of the original item is not English, the language will be indicated. Translations are not abstracted where an abstract of the original item has appeared in *NSA*.

INDEXES TO NSA

Subject, personal author, corporate author, and report number indexes appear in each issue and are cumulated quarterly, semiannually, and annually. The cumulative report number index annually cumulates all report numbers in all volumes.

AVAILABILITY OF PUBLICATIONS ABSTRACTED

The public availability of all U. S. Atomic Energy Commission reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations taken from *Dissertation Abstracts* are available from University Microfilms, Inc., 315 N. First Street, Ann Arbor, Michigan.

Most of the published literature abstracted in *NSA* is on deposit at the Oak Ridge Institute of Nuclear Studies Library, Oak Ridge, Tennessee, (a USAEC depository library) and is available through interlibrary loan. When requesting papers from this source, it is important that *NSA* volume and abstract number be cited.

MIAMI UNIVERSITY LIBRARY

HOW TO OBTAIN NUCLEAR SCIENCE ABSTRACTS

NSA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37831.

Government agencies may obtain *NSA* free of charge.

NSA is available to the general public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., as follows:

For the 24 regular issues, $30.00 domestic, $37.00 foreign. A single issue costs $1.75, plus 25 per cent for foreign mailing. Domestic rates apply to the United States, Canada, Mexico, and Central and South American countries except Argentina, Brazil, British and French Guiana, Surinam, and British Honduras. Foreign rates apply to the countries excepted above and to all other countries throughout the world.

For the quarterly, semiannual, and annual indexes, $22.00 domestic, $25.00 foreign.

Multivolume subject and author indexes are available as follows:

Vols. 1–4 (1948–1950) Johnson Reprint Corporation, 111 Fifth Avenue, New York, N. Y. 10003, $30.00.

Vols. 5–10 (1951–1956) Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $5.25.

Vols. 11–15, Subjects, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $19.00.

Vols. 11–15, Personal Authors, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $14.25.

Vols. 11–15, Corporate Authors, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $2.50.

Annual Indexes are available separately from the U. S. Government Printing Office as follows:

Vol. 16, Subject and Authors, $9.75.

Vol. 17, Subject and Authors, $12.25.

Cumulative Report Number, $5.25.

ACKNOWLEDGMENTS

Agreements between the United States Atomic Energy Commission and the following organizations with regard to providing continuing services and specific literature coverage for *Nuclear Science Abstracts* are gratefully acknowledged:

American Institute of Physics; Atomic Energy of Canada Limited; Atomic Energy Research Establishment, United Kingdom; European Atomic Energy Community (EURATOM); Gmelin Institute; International Atomic Energy Agency; Japan Atomic Energy Bureau—Japan Atomic Energy Research Institute; Netherlands Patent Office; Reactor Centrum Nederland.

MIAMI UNIVERSITY LIBRARY

TABLE OF CONTENTS

Volume 18, Number 15, August 15, 1964

Category	*Page*
BIOLOGY AND MEDICINE	3375
General	3375
Ecology	3378
Metabolism, Tissue Distribution, and Toxicology	3378
Radiation Effects	3382
Radiation Effects Therapy and Countermeasures	3406
Radiation Hazards and Protection	3409
Radiotherapy and Radiodiagnosis	3409
CHEMISTRY	3414
General	3414
Analytical Procedures	3414
Inorganic and Physical Chemistry	3420
Organic Chemistry	3439
Radiation Chemistry and Radiochemistry	3441
Separation Processes and Procedures	3460
ENGINEERING	3464
General	3464
Facilities and Equipment	3465
Heat Transfer and Fluid Flow	3467
Materials Testing	3469
Protective Structures	3470
Vacuum Engineering	3470
GEOLOGY AND MINERALOGY	3471
General	3471
Natural Radioactivity and Fallout	3471
Techniques and Equipment	3473
Thorium and Uranium Minerals	3474
HEALTH AND SAFETY	3475
INSTRUMENTATION	3480
General	3480
Radiation Detection	3483
ISOTOPE TECHNOLOGY	3493
General	3493
Industrial Applications	3493
Separation and Production	3494
MATHEMATICS AND COMPUTERS	3495
METALS, CERAMICS, AND OTHER MATERIALS	3497
General	3497
Corrosion	3500
Fabrication	3502
Properties and Structure	3506
Radiation Effects	3518
METEOROLOGY	3524
PHYSICS	3525
General	3525
Accelerators	3535
Astrophysics and Cosmology	3537
Atomic Physics	3539
Cosmic Radiation	3545
Criticality Studies	3545
Direct Energy Conversion	3546
Elementary Particles and Radiations	3547
Field Theory and Quantum Mechanics	3562
Geophysics	3568
Low Temperature Physics	3570
Neutron Physics	3574
Nuclear Properties and Reactions	3577
Plasma Physics and Thermonuclear Processes	3599
Shielding	3615
REACTOR TECHNOLOGY	3617
General	3617
Auxiliaries and Components	3618
Criticality Studies	3622
Design and Feasibility	3626
Fuels	3627
Power and Power-Breeder Reactors	3629
Production Reactors	3634
Propulsion and Space	3635
Research and Test Reactors	3635
WASTE DISPOSAL AND PROCESSING	3638
GENERAL AND MISCELLANEOUS	3640
CORPORATE AUTHOR INDEX	INDEX-1
PERSONAL AUTHOR INDEX	INDEX-9
SUBJECT INDEX	INDEX-50
REPORT NUMBER INDEX	INDEX-135

Managing Editor

John W. Norris

Assistant Managing Editor

Donald D. Davis

Associate Editor

Robert C. Kelly

Production Editor

Lawrence T. Whitehead

Technical Editor

David E. Bost

Subject Index Editor

Everett J. Hoffman

Evaluators

William D. Matheny
John H. Mitchell
Mary H. Newman
Lee M. Thompson

Subject Authority Editor

Thomas R. Henley

Corporate Authority Editor

Clara L. Fox

Abstractors

D. Lamar Cason
James R. Dulaney
Helen M. Gant
Bernard O. Griggs
Mary Catherine Grissom
Miriam P. Guthrie
Phyllis Hansen
Thomas F. Heagerty
Carolyn D. Houston
Rose V. Jermain
Julia Redford
Ned W. Rizzardi
Lila B. Smith
Charles E. Stuber
Martha J. Thomas
Robert E. Upchurch
Anne G. Ward
David C. West

Exchanges

Margaret L. Pflueger

Report Code Authority

Hannah B. Mayfield

Report Number Index Editor

Bobbie J. Dunlap

Scheduling and Publishing Coordinator

Henry H. Lansford

Communication concerning the editorial policy and content of *NSA* should be addressed to the Managing Editor, *Nuclear Science Abstracts*, AEC Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37831.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, May 20, 1963.

Volume 18, Number 15 August 15, 1964

NUCLEAR SCIENCE ABSTRACTS

BIOLOGY AND MEDICINE

General

25037 (AHSB(RP)R-39) RADIATION AND SKIN. PROCEEDINGS OF SYMPOSIUM, ATOMIC ENERGY ESTABLISHMENT, WINFRITH, NOVEMBER 14, 1963. E. T. Wray, ed. (United Kingdom Atomic Energy Authority. Authority Health and Safety Branch. Radiological Protection Div., Harwell, Berks, England). Mar. 1964. 102p.

Separate abstracts were prepared on eight papers presented at this symposium. (C.H.)

For abstracts of individual papers see: 25038, 25056, 25080, 25081, 25082, 25083, 25213, and 25214.

25038 (AHSB(RP)R-39(p.1-10)) ANATOMY AND PHYSIOLOGY OF THE SKIN. A. M. Laylee (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England).

The anatomy and physiology of the skin are reviewed. Emphasis is placed on inflammatory reactions in injured skin. (C.H.)

25039 (BLG-44) L'IODE-132. (Iodine-132). R. Stiennon-Bovy (Centre d'Étude de l'Énergie Nucléaire, Brussels). Apr. 15, 1960. 19p. (R-1829)

It is shown that, owing to its nuclear characteristics, ^{132}I is a first choice for certain medical purposes and is superior to ^{131}I. In spite of its short half life (2.4 hr) this isotope can be used during a long period of time and far from a production center if kept in the presence of its parent, ^{132}Te (77 hr) and separated therefrom at the moment of utilization. A method is indicated for the separation of ^{132}I from ^{132}Te, and some data are given in order to facilitate the utilization of ^{132}I. (auth)

25040 THE EXTERNALLY MONITORED THORACIC RADIOACTIVITY OF ANESTHETIZED DOGS AFTER INTRAVASCULAR EQUILIBRATION OF A PLASMA TRACER. J. Lammerant and Ch. De Schryver (Facultés Universitaires Notre Dame de la Paix, Namur, Belg.). Acta Cardiol., 17: 166-77(1962).

Methods for evaluation of cardiac hemodynamics were explored in dogs by measuring the radioactivity related to the intravascular equilibrium phase of intravenously injected radioiodinated (^{131}I) human serum albumin (RISA), monitored over the anterior chest wall during chloralose anesthesia, using a wide-angle collimation recording technique. Ten to 20 μC of RISA was injected intravenously, and a typical dilution curve corresponding to the first transit of the tracer in the field of the counter was recorded. A standard 5-min period was allowed after the injection for complete mixing of the tracer dose within the total blood volume. The thoracic activity was then recorded continuously up to 90 min after the injection. Over a 1.5-hr observational period the thoracic activity exhibited a systematic decrease which equaled about twice the corresponding disappearance rate in plasma activity. Mean decrease of thoracic activity amounted to $18.48 \pm 1.12\%$ of control value and was significantly greater than the $11.48 \pm 0.75\%$ mean diminution in plasma activity. The discrepancy is consistent with a mechanism of total blood volume redistribution at the expense of the thoracic pool under the influence of anesthesia. Differences between mean changes and lack of correlation between individual changes in thoracic and plasma activity, indicate that extravascular loss of the plasma tracer cannot be considered responsible for the observed decrease in surface counting rate. In fact, the fraction of the tracer dose escaping into that part of the interstitial space located in the field of the counter should necessarily contribute to the surface-monitored counting rate. Hence, provided the volume and geometry of the blood viewed by the counter are kept constant, the surface counting rate may be expected to exhibit less change, if any, than plasma activity. Since the reverse situation was usually seen, changes in the intrathoracic blood volume are considered to be the alternative explanation. (BBB)

25041 BUFFER DISTRIBUTION IN ISOLATED PERFUSED RAT HEART MEASURED BY RUBIDIUM 86. Joseph C. Shipp, James R. Spencer, and Lamar E. Crevasse (Univ. of Florida, Gainesville). Am. J. Physiol., 206: 905-8(Apr. 1964).

The pattern of distribution of ^{86}Rb in sections of the isolated perfused heart of rats was determined as a measure of uniformity of coronary artery flow. Results suggest that coronary flow was uniform after nonrecirculated perfusion for 15 min. Similar results were obtained in hearts perfused for 30 and for 60 min. The distribution of ^{86}Rb was comparable in hearts perfused for 30 min with perfusate circulated through either coarse porosity, sintered-glass filters or 5-μ Millipore filters. A non-uniform distribution of isotope was demonstrated with ligation of branches of coronary arteries and with the introduction of air. The results suggest that hearts perfused by recirculation of buffer through coarse porosity, sintered-glass filters have a uniform distribution of perfusate throughout the heart. (C.H.)

25042 MEASUREMENT OF MYOCARDIAL BLOOD FLOW USING KRYPTON 85. Lawrence S. Cohen, William C. Elliott, and Richard Gorlin (Peter Bent Brigham Hospital and Harvard Medical School, Boston). Am. J. Physiol., 206: 997-9(May 1964).

Krypton-85 in solution was administered as a single rapid injection into the left ventricle in 11 human and 9 canine subjects. The myocardial clearance of the portion of injectate which entered the coronary system was sampled at the coronary sinus and coronary flow was derived from Kety's equation. A comparison with nitrous oxide or antipyrine-^{131}I coronary flows revealed a correlation coefficient of 0.86 ± 0.22 (P = 0.005) with no statistically significant difference between paired samples. (auth)

25043 THE APPLICATION OF RADIOISOTOPES TO THE STUDY OF CEREBRAL BLOOD FLOW, COMPARISON OF THREE METHODS. Granville E. Horton and Philip C. Johnson, Jr. (Baylor Univ., Houston, Tex.). Angiology, 15: 70-4(Feb. 1964).

Attempts were made to confirm the value of several new radioisotope techniques which have been described as being useful for estimating cerebral flow. This was done by first comparing the results of the three radioisotope methods and from these results choosing the best method to compare with the nitrous oxide method, as a standard technique. These three separate methods for estimation of cerebral flow use intravenously injected ^{131}I-iodopyracet and externally placed detectors. The time-activity curves produced by the two detectors on the head and one on the chest wall placed over the heart were compared before and after treatment with a drug (isoxsuprine) thought to cause vasodilation of the cerebral vessels. These studies showed statistically significant increases in the volume index and the flow ratio after the administration of this drug. Of the three methods, only the ratio formula appears to give results related to flow. (BBB)

25044 CURRENT OBJECTIVES IN BIOASTRONAUTICS AND AEROSPACE MEDICINE. Benjamin A. Strickland, Jr. (Andrews Air Force Base, Washington, D. C.). Military Med., 129: 33-7(Jan. 1964).

Some problems in aerospace medicine under study by the Air Force are discussed, including protection against radiation fields in outer space and against some effects of nuclear explosions. One problem of radiobiology considered is radiation injury that can be produced by various sources, especially from ambient space radiation such as that encountered in the Van Allen belts. The problem of flash blindness is discussed with reference to the hypothetical situation of a pilot flying a high-performance vehicle who is suddenly confronted with a nuclear detonation in his direct line of vision. It is concluded that considerable additional work will be required to develop a foolproof, standardized system for eye and vision protection. Also considered are aerospace problems concerning weightlessness, deceleration, recycling metabolic waste products, effect of drugs on astronaut performance, and handling of rocket fuels. (BBB)

25045 SPACE MEDICINE IN THE MANNED SPACE FLIGHT PROGRAM. George M. Knauf (National Aeronautics and Space Administration, Washington, D. C.). Military Med., 129: 199-204(Mar. 1964).

The NASA program for biomedical studies relating to space flight is reviewed, with reference to some of the hazards expected, including those from ionizing radiations. Investigations to determine the extent and configuration of the radiation belt surrounding the earth are being conducted by NASA. The potential hazards, resulting from radiation present in the inner and outer Van Allen belts and from solar proton events which may be encountered beyond the belts, are the subjects of intensive study. The AEC is conducting radiation studies under a Manned Spacecraft Center contract to determine the suitability of various materials for use in the construction of the Apollo spacecraft. Some materials which would be desirable for structural use cannot be employed because of the extensive hazardous secondary radiation they produce under proton bombardment. (BBB)

25046 PHARMACOLOGY AND TOXICOLOGY: DISEASES OF EXTERNAL ORIGIN. Heinrich Wiesener (Staedtische Kinderklinik Charlottenburg, Berlin). Monatsschr. Kinderheilk., 111: 309-15(Aug. 1963). (In German)

A review is presented of diseases caused by physical and chemical agents used in medicine, particularly ionizing radiations and drugs. The hazards of diagnostic radiation in children are discussed and recommendations made for dose reduction and gonadal shielding. (BBB)

25047 FIELD TESTS WITH SEXUALLY STERILE MALES FOR CONTROL OF AEDES AEGYPTI. Harvey B. Morlan, Elmo M. McCray, Jr., and John W. Kilpatrick (Communicable Disease Center, Atlanta). Mosquito News, 22: 295-300(Sept. 1962).

The use of ^{60}Co γ radiation for sterilization of male mosquitos is reported, on the basis of tests conducted in Escambia County, Florida, comparing natural populations of A. aegypti in two areas of sterile-male release and in two untreated check areas. The male pupae were sterilized by exposure to 11,000 to 18,000 r. Batches of 1100 or 2200 irradiated pupae were placed in water held in one-half-pint or one-pint cartons, for transportation by commercial air express, and maintained in insulated boxes at temperatures of about 60° to 70°F. The pupae were distributed to release sites within 24 hr after irradiation. Release Area I, located about 5 miles west of downtown Pensacola, consisted of about 238 acres. Release Area 2, located about 7 miles from downtown Pensacola, was a rural settlement of about 48 acres. In Area I, ratios of sterile normal males ranged from 47:1 to 941:1; Area 2, ratios ranged from 25:1 to 148:1. In Area I, the releases may have reduced but failed to eradicate natural populations of A. aegypti. Comparative data on populations failed to demonstrate any conclusive differences between the area of sterile male release and the untreated area. In release Area I, 25% of eggs collected hatched compared to 42% collected in control Area A. In a few instances, it was shown that the infestation of A. aegypti in the release area was introduced by the movement of the pupae-containing receptacles into the area. The estimated ratios of sterile males to normal males were obtained from averages applied to the entire release area but do not necessarily represent actual relative numbers at any specific location. The extent of dispersion of sterile males from a limited distribution of irradiated pupae was unknown. Since completion of these field releases, laboratory studies have indicated that a few days difference in age of males favors the mating success of younger mosquitoes. Thus, releases of only once each week, while desirable from the viewpoint of logistics, are probably less effective for A. aegypti control than twice-weekly releases. It is concluded that the adaptation of the sterile-male method for mosquito control requires additional investigation, especially of the dispersion of males under field conditions. (BBB)

25048 FAST-NEUTRON ABSORPTION DOSE ESTIMATED FROM THE ELEMENTAL CONSTITUTION OF BONE MARROW OF SMALL ANIMALS. Osamu Yamamoto, Shozo Sawada, and Haruma Yoshinaga (Hiroshima Univ.). Nippon Igaku Hoshasen Gakkai Zasshi, 23: 141-5 (May 25, 1963).

Attempts were made to determine why bone marrow injury is less severe in animals irradiated with neutrons than with x or γ rays at equivalent doses. If the H content of bone marrow is smaller than that of other soft tissues, this might explain the decrease in marrow dose from neutrons. To ascertain whether the H content of the bone marrow is smaller than that of the other soft tissues, the elemental constitution of various organs of rats and the estimated dose absorbed by such organs from 14.4-Mev neutrons were studied. The C, H, O, and N content are given for the following tissues: muscle, liver, kidney, spleen, intestine, fat, and bone marrow. The method of estimating the neutron absorbed doses is described, using the principles of conservation of energy and momentum of classical mechanics. Using an equation, the average energy dissipation per unit flux for the four common elements in the tissue, (H, C, N, O) and available data on cross sections and energy transfer was derived. With these values, absorbed dose per unit flux of each soft tissue irradiated with 14.1-Mev neutrons was estimated in rad units with consideration of atomic density (atoms/g). From the elemental constitution, especially the proportion of H, and the absorbed doses estimated for bone marrow and other soft tissues except fat, it could not be concluded that a decrease in absorbed dose because of the smaller content of H in bone marrow is responsible for decreased bone marrow injury. The H content of bone marrow is ~9.8% compared with 10.0 to 10.2 for other soft tissues. For an alternative explanation, the geometric features of bone should be considered. (BBB)

25049 CLASSIFICATION OF LEUKEMIAS BY SENSITIVITY OF CELLS TO DRUGS. K. Kimura and S. Kurita. Nippon Ketsueki Gakkai Zasshi, 26: 94-100(Feb. 1963). (In Japanese)

Leukemias are classified according to their response to drugs and radiation. (BBB)

25050 SIMULTANEOUS KINETICS STUDY OF ^{131}I-HIPPURAN AND ^{125}I-ROSE BENGAL BY THE APPLICATION OF DOUBLE ISOTOPE TECHNIQUE. II. A METHOD FOR STUDYING THE HEPATORENAL FUNCTIONAL INTERRELATION. Yawara Yoshitoshi (Tokyo Univ.) and Masaaki Kashima. Radioisotopes (Tokyo), 12: 392-400 (Nov. 1963). (In Japanese)

^{125}I-rose bengal and ^{131}I-hippuran (or inversely, ^{131}I-rose bengal and ^{125}I-hippuran) were intravenously injected at the same time, and their radioactivities in blood were separately measured by the combination of the two-channel pulse height analyzer and the well-type scintillation detector. This combined kinetics study was made in the cases of normal and diseased subjects and the results are summarized in a table. The time curves of extraction ratio E(t) of ^{125}I-hippuran and ^{131}I-rose bengal in the same subject could be simultaneously obtained with renal and hepatic vein catheterizations by the application of this double isotope technique. (Nucl. Sci. Abstracts of Japan, 3: No. 2 (Apr. 1964))

25051 A METHOD FOR RECORDING RAPID CHANGES IN RADIATION INTENSITY APPLIED TO CARDIOVASCULAR STUDIES. E. Berne, L. Hallberg, and S. E. Lindell (Sahlgren's Hospital, Goteborg). Scand. J. Clin. Lab. Invest., 13: 476-80(1961).

Improved techniques for scintillation registration of injected radioisotopes are considered. (BBB)

25052 RECENT DEVELOPMENTS IN MULTICOMPARTMENT TRACER ANALYSIS. H. E. Hart (Montifiore Hospital, New York) and C. A. Weller. Trans. N. Y. Acad. Sci., 26: 64-74(Nov. 1963).

Theoretical aspects of the use of radioisotopes in biological and medical research are considered. (BBB)

25053 EXPERIMENTAL VARIATIONS ASSOCIATED WITH THE PHENOMENON OF SECONDARY TUMORIGENESIS IN THE RAT: ACTION OF STRONTIUM SULFATE. V. Carminati and M. Chirico (Istituto Nazionale per lo Studio e la Cura dei Tumori, Milan). Tumori, 47: 265-72(July-Aug. 1961). (In Italian)

Various substances, which may act as an irritant and cause inflammatory reactions, have been previously shown to induce tumor formation when implanted in animals at the same time, but at a different site, as a carcinogenic agent. It is demonstrated that Sr can act as such a secondary tumorigenic agent. Fifty rats were bilaterally injected in the inguinal regions with 1 ml of 1.5% $SrSO_4$ solutions and in the left side with 10 mg of 3,4-benzpyrene. An inflammatory lesion developed in the right groin in 15 rats and in two animals a tumor appeared at the site of $SrSO_4$ injection on this side. Histologically, these Sr-induced tumors appeared to be sarcomas composed of polymorphous cells. Both animals also showed tumors of a different cell type on the benzpyrene-injected (left) side; these were classified as spindle-cell sarcomas. These animals were sacrificed at 186 and 321 days, at which time these bilateral tumors were noted. Both tumors found on the right side contained numerous giant cells, and one contained numerous mast cells. The low incidence of secondary tumors at the Sr injection site may be due to its diffusion from the site, since inflammatory reactions were noted in only 15 cases. In related experiments using silica injections, secondary tumors were produced in 42% of the animals. (BBB)

25054 EXPERIENCE IN THE USE OF SEMICARBAZIDE-CADMIUM THERAPY IN PATIENTS SUFFERING FROM MALIGNANT NEOPLASMS IN THE INCURABLE PERIOD. M. L. Volokhonskaya, N. D. Voronko, S. I. Vysheslavtsev, and F. Yu. Yaroshevskii (Polyclinic No. 3, Academy of Sciences, USSR). Vopr. Onkol., 9: No. 6, 92-104(June 1963).

Ninety patients regarded as incurables were observed, and it was concluded that the cadmium-semicarbazide therapy previously suggested meets standard aims. Preparations used were: ^{113}CdO—oxide of the stable isotope of ^{113}Cd; 0.1 g ^{113}CdO was ground in a porcelain mortar and carefully mixed with 15.0 g of biochinol, and sterilized by boiling; 2.0 g of the preparation given intramuscularly each day following the rules of biochinol administration amounted to 25 injections per course of treatment. A second course was repeated in 2 to 3 months. An additional preparation used as CdI_2. Semicarbazide hydrochloride is hygroscopic; it is stored in waxed paper, or a glass vessel with a coated cork. It is unsuitable after becoming moist and yellowed. Urea (carbamide), 0.2 to 0.25 g/½ cup of alkaline mineral water, is given once a day. These preparations were prescribed along with general reinforcement drugs (according to indications, transfusion of blood and blood proteins, and vitamins). Hematological and biochemical studies of blood, urine analyses, and x-ray examination were carried out following the usual laboratory and x-ray methods. It was found that Cd-semicarbazide therapy for incurable oncological patients is a powerful symptomatic agent. The pain

syndrome was remarkably relieved upon its use in all cases. The simplicity of use allows its prescription at the home and under ambulatory-polyclinical conditions. The therapy was found to evidence selective specific action of these preparations used on tumor tissue. Side toxic effects of preparations used at prescribed dosages appeared infrequently, and were not serious. The action of the preparations on tumor metastases makes it necessary that this therapy be combined with the maximum possible surgical removal of the primary tumor. There should be no interruptions in the therapy used, since they activate tumor growth and lead to ineffectiveness of the second therapy course. (TCO)

Ecology

25055 (NP-13985) RADIOACTIVE FOOD CHAINS IN ARCTIC REGIONS. Jorma K. Miettinen (Helsinki, Univ.). [1963]. 13p.

Results are summarized from investigations of bioenvironmental radioactivity in the Arctic regions of Scandinavia and Alaska that revealed high body contents of ^{90}Sr and ^{137}Cs in animals and man. It is pointed out that the lichen-reindeer-man food chain is the most important in Arctic regions, but hydrospheric food chains including fish also play an important part in the Arctic diet. Data are presented on the ^{90}Sr and ^{137}Cs content in samples of vegetation and meat, bones, and milk from cows and reindeer from 1959 to 1964; the ^{137}Cs content of fish caught in 1963; dietary surveys; quantitative measurements of ^{137}Cs in diet, the ^{137}Cs body burden of individuals residing in Lapland, Finland, and northern Alaska as determined by whole-body counting; and measurements of natural radioactivity in soil due to ^{226}Ra and the radon daughters, ^{210}Pb and ^{210}Po. Seasonal variations in radioactivity of the diet are discussed and results of measurements are compared with results of similar measurements in Sweden. The data were used to calculate the present radiation dose of Lapps and Eskimos due to internal contamination by fallout fission products and to estimate future doses should nuclear testing be resumed or accidents occur. It is concluded that within the next 20 yr large groups of people residing in reindeer- and caribou-meat-consuming regions of Alaska, Canada, Scandinavia, and the USSR may exceed the genetic maximum permissible levels of radiation established for large population groups. It is pointed out that this same group of people have a body content of the natural radionuclides RaD (^{210}Pb) and RaF (^{210}Po) considerably higher than normal. (C.H.)

Metabolism, Tissue Distribution, and Toxicology

25056 (AHSB(RP)R-39(p.79-86)) SKIN PERMEABILITY AND RADIOACTIVE CONTAMINATION. R. T. Tregear (Gt. Brit. Chemical Defence Experimental Establishment, Porton, Wils, England).

Mechanisms of skin permeation by radioactive contaminants are reviewed. It is concluded that skin permeability is passive and that it is possible to reconstruct the likely fate of a radioactive contaminant falling on the skin. (C.H.)

25057 (UR-645) A PRELIMINARY STUDY OF BEHAVIORAL EFFECTS IN PIGEONS EXPOSED TO MERCURY VAPOR AT A CONCENTRATION OF 0.1 MG/M^3. R. P. Beliles, R. S. Clark, P. R. Belluscio, C. L. Yuile, and L. J. Leach (Rochester, N. Y. Univ. Atomic Energy Project). Apr. 13, 1964. Contract W-7401-eng-49. 8p.

Exposure to Hg vapor, 0.08 mg/m^3, 6 hr/day for 20 weeks, had no significant effects either on histology or on behavioral patterns and rates of responding elicited from two exposed pigeons. Further studies of Hg vapor effects at or near the threshold limit value should employ additional species, and experimental durations of at least one year should be planned. (auth)

25058 (OTS-63-11008(p.1-5)) THE USE OF ISOTOPES IN THE INVESTIGATION OF FLOWERING AND NECTAR FORMATION IN LINDEN TREES. D. V. Girnik. Translated from Tr. po Fiziol. Rast. Agrokhim. i Pochvoved., 143-7(1957).

Tracer studies with $^{14}CO_2$ showed that in linden trees, the photosynthates produced in the leaves during the flowering period are utilized in nectar production. This explained the dependence of nectar formation on weather conditions prevailing during the flowering period, as observed by investigators. The photosynthates produced by a leaf were found to be transferred primarily to the flowers and fruit situated in its axil. Only a small part reached the cymes situated in the axils of adjacent leaves. A cyme, situated in the axial of a damaged leaf, developed using photosynthates supplied by other leaves. Radioactive carbon, assimilated by leaf during a 30-minute feed with $^{14}CO_2$ is transferred from the leaf and reaches the nectar of linden flowers and fruit in several days. (auth)

25059 (OTS-63-11008(p.6-14)) THE USE OF THE STABLE NITROGEN ISOTOPE N^{15} IN INVESTIGATING THE ROLE OF COPPER IN PLANT ASSIMILATION OF AMMONIA AND NITRATE NITROGEN. L. K. Ostrovskaya, B. A. Geller, and G. M. Yakovenko. Translated from Tr. po Fiziol. Rast. Agrokhim. i Pochvoved., 168-76(1957).

Using ^{15}N it was found that copper deficiency inhibits protein synthesis in oat leaves fed ammoniacal nitrogen. This supported the assumption that copper affects some stage of this process. Protein synthesis from ammoniacal nitrogen in sugar beet leaves was also decreased by copper deficiency, though to a lesser extent than in oats. Although sugar beets assimilated nitrate nitrogen better than ammoniacal nitrogen, it was impossible to detect any influence of copper upon protein synthesis during nitrate nitrogen nutrition. In sugar beet leaves, the assimilation of and synthesis of protein from nitrate nitrogen was much more intensive than the assimilation of ammoniacal nitrogen. This difference was observed both day and night, although during the day, with photosynthesis, it was increased several fold. In sugar beet roots, as opposed to leaves, the assimilations of ammoniacal and nitrate nitrogens proceed at an equal rate. The different reactions of sugar beet leaves to copper deficiency in nitrate and in ammonia nutrition helped confirm the existence of distinct pathways of protein synthesis from oxidized and reduced nitrogen fertilizers. (auth)

25060 EXPERIMENTAL BILIARY OBSTRUCTION: EFFECT OF THOROTRAST ON LYMPH AND SERUM BILIRUBIN LEVELS. Allan E. Dumont, Simon H. Stertzer, and John H. Mulholland (New York Univ., New York). Am. J. Physiol., 202: 704-6(Apr. 1962).

Thorotrast was used to test the hypothesis that the conversion of heme to bilirubin occurs in the cells of the reticuloendothelial system (RES). Previous use of RES blocking agents in experiments designed to confirm this hypothesis has resulted in data that are equivocal. Determination of bilirubin in thoracic duct lymph provided a more sensitive guide to bilirubin production, in the presence of extrahepatic biliary obstruction, than studies of serum bilirubin alone. The effect of Thorotrast on bilirubin levels in the thoracic duct lymph and sera was determined

in dogs with experimental biliary obstruction. The results indicate that Thorotrast stops the production of bilirubin and support the view that the normal site of bile pigment production is the RES. Injection of India ink, another agent frequently used to study RES function, had no significant effect on liver blood flow. It is suggested that the effect of Thorotrast (colloidal ThO_2) on bilirubin formation results from some metabolic alteration in the cells of the RES rather than mere blockade of cell surfaces. A single injection of Thorotrast in rabbits produces degenerative changes in both Kupffer cells of the liver and phagocytic cells of the spleen. These cytotoxic changes are histologically evident in 4 to 6 hr. (BBB)

25061 BIOLOGICAL TRANSMETHYLATION. F. Schlenk. Argonne Natl. Lab. Rev., 1: 12-14(Apr. 1964).

The roles of methionine and S-adenosylmethionine in biological transmethylation processes are outlined. (T.F.H.)

25062 AUTORADIOGRAPHIC STUDIES ON THE DISTRIBUTION OF ^{131}I IN THE TRACHEA OF THE GUINEA PIG. W. Lehrnbecher and M. Hoebel (Universität, Heidelberg). Arzneimittel-Forsch., 13: 652-4(Aug. 1963). (In German)

Male adult guinea pigs were thyroidectomized and 4 weeks later injected intraperitoneally with 5 mC carrier-free $Na^{131}I$ (stabilized with $Na_2S_2O_3$). After 5 hr the trachea was removed and prepared for autoradiography. Radioiodine was not uniformly distributed in the trachea but selectively localized in certain structures. Most of the radioactivity in the tracheal mucosa was present in the region of the multilayered goblet cells in the columnar epithelium. The radioactive zone of the mucosa was sharply demarcated from the connective tissue (substantia propria) which contained much less ^{131}I. In this connective tissue the activity present was mainly confined to vascular endothelium, especially the capillaries. Radioiodine completely lacking in the hyaline cartilage. Although the ^{131}I appeared to be selectively taken up by the goblet cells, this could not be determined with precision because of inadequacies of the technique. However, the blackening of the film corresponded to the regions occupied by these cells as revealed by mucin stains. The elastin fibers of the esophagus occasionally took up ^{131}I. The failure of hyaline cartilage to incorporate ^{131}I is in contrast to its ability to take up ^{35}S, ^{32}P, ^{55}Fe, and ^{59}Fe. (BBB)

25063 LABELED MOLECULES—SOME PROBLEMS. Atomes (Paris), No. 208, 89-91(Mar. 1964). (In French)

The use of labeled glucose molecules in the investigation of respiration is discussed briefly. The discovery of respiratory tissues discrimination between glucose molecules marked at different carbon atoms is mentioned. (M.J.T.)

25064 THE PRODUCTION OF ANTHOCYANINS IN IMPATIENS BALSAMINA L. BLOSSOMS AFTER ACUTE IRRADIATION OF THE UNCOLORED PETALS. Eva Klozova (Inst. of Experimental Botany, Prague). Biol. Plant., Acad. Bohemoslov., 5: 120-3(Apr. 1963).

The direct influence of x irradiation on the production of anthocyanins in detached uncolored petals of Impatiens cultivated in vitro was investigated. Petals were detached from red flower buds (the red form contains two pelargonidine glucosides). After rinsing in sterile water, symmetrical petals were dissected; at this stage they were pale green in color. Part of the petals were irradiated with an x-ray dose of 1000 r, and the irradiated and control petals were then cultivated in White's fluid medium. The cultures were grown in continuous artificial light at 15 to 20°C, for three weeks. Anthocyanins began to appear in the petals after the 3rd and 4th day of cultivation and the petals began to grow at the same time. The petals were analyzed both qualitatively and quantitatively for anthocyanin content. A comparison of the quantitative anthocyanin content of the irradiated and control petals showed that at the beginning of cultivation (one week after irradiation), there was very little difference between the control and irradiated petals, the anthocyanin content being slightly raised in the latter. After three week's cultivation, the controls had more anthocyanin than the irradiated petals (>40%). Thus the results of colorimetric measurements show that shortly after irradiation, the production of anthocyanins remains at practically the same level or rises somewhat, while later, a striking decrease occurs. A qualitative analysis of anthocyanin content made chromatographically showed no differences between the control and irradiated petals. However, cyanidin also appeared in both the control and irradiated petals. Since no basic changes occurred in anthocyanin production shortly after irradiation (one week), it is suggested that the final phase of the biosynthesis of anthocyanins was not damaged by irradiation. However, at a later period, the marked decrease in the quantitative anthocyanin content could mean that irradiation inhibits the systems forming new precursors for the synthesis of further anthocyanins. A dilution of the anthocyanins occurred in the irradiated petals: they grow, but the amount of anthocyanins did not rise in proportion to the increase in weight of the petals. This indicates that the irradiated petals mainly contain anthocyanins which were formed soon after irradiation and for which the precursors were present before exposure to x rays, while the new anthocyanins are either not formed at all or only in smaller quantities than in the control petals where anthocyanins increase in size of the petals. (BBB)

25065 MAST CELL DAMAGE AND VASCULAR INJURY IN THE RAT: AN ELECTRON MICROSCOPIC STUDY OF A REACTION PRODUCED BY THOROTRAST. D. A. Rowley (Sir William Dunn School of Pathology, Oxford). Brit. J. Expti. Pathol., 44: 284-90(June 1963).

Rats injected intravenously with 0.5 ml of Thorotrast developed a florid erythema of the skin of the ears and paws within a few minutes (the preparation contained 24 to 26% stabilized colloidal ThO_2, 25% aqueous dextrin, and 0.15% preservative). Prostration and slight edema of the snout and paws developed within 15 to 30 min, but the rats recovered in four to six hr. When spreads of paw areolar tissue taken from rats injected intravenously or intradermally with Thorotrast were stained with toluidine blue, widespread degranulation of mast cells was seen. Little or no mast cell degranulation occurred in spreads from paws injected with saline or 5-hydroxytryptamine. Thorotrast produced in rats a reaction apparently identical with that produced by other mast cell-damaging agents. Tests to determine whether the reaction was due to ThO_2 or to the medium used for the colloidal suspension showed that dextrin in Thorotrast was responsible for producing mast cell damage. The vascular injury was presumably mediated by 5-hydroxytryptamine and histamine released from damaged mast cells since it was prevented by combined treatment with antihistamine and anti-5-hydroxytryptamine drugs. The extent and severity of mast cell damage was the same in paw areolar tissue 30 min, 2 and 4 hr after injection of Thorotrast. At these times mast cell granules were widely dispersed in edematous areolar tissue. Postcapillary venules were dilated and packed with erythrocytes 8, 15,

and 30 min after injection of Thorotrast. At these times formed elements of the blood and particles of ThO_2 penetrated the walls of postcapillary venules primarily through junctions between endothelial cells; however, particles of ThO_2 also entered endothelial cells in vesicles adjacent to junctions. 5-Hydroxytryptamine injected into paws produced severe local edema but did not cause degranulation of mast cells. However, the vascular injury produced by 5-hydroxytryptamine appeared to be the same as that produced by Thorotrast. (BBB)

25066 THE ULTRASTRUCTURE ASPECTS OF THE LIVER IN LACERTA STIRPIUM AND ACCARA LATIFRONS AFTER INTRAPERITONEAL INJECTION OF THORIUM DIOXIDE (THOROTRAST). A. Porte, J. P. Zahnd, and A. Batzenschlager (Institut d'Embryologie, Strasbourg and Institut d'Anatomie Pathologique, Faculte de Medecine, Strasbourg). Compt. Rend. Soc. Biol., 157: 1791-5(1963). (In French)

Male lizards (Lacerta stirpium) and fish (Accara latifrons) of both sexes received intraperitoneal injections of ThO_2. They were sacrificed at time intervals from 2 hr to 3 days after the injection, and the hepatic cells were examined. The examination of the lizard at 2 hr shows the passage of ThO_2 particles into the Disse space and intercellular spaces. At 5 hr the sinus openings are filled with thorotrast, and the endothelial cells have proliferated. Passage of thorotrast into the intercellular spaces is not observed after the eighth hour. The hepatic cells contain, after the first few hours, in their subapical part, dense bodies in which thorotrast is agglomerated. The same picture is present in the fish, but the endothelial reactions are less early and less intense. The significance of these results is discussed. (J.S.R.)

25067 STRONTIUM IN SOME INDIAN VEGETABLES. B. C. Ray Sarkar and U. P. S. Chauhan (Defence Science Lab., Delhi). Current Sci. (India), 32: 418-19(Sept. 1963).

The calcium and strontium contents of radish leaves, mustard leaves, spinach, methi leaves, lettuce, cabbage, and lawn grass were determined. With the exception of radish leaves (>800 μg/g), the strontium content/gram of dry matter was <100 μg. A combination of paper partition chromatography for separating Sr from Ca and Ba using the solvent system $CH_3OH:HCl:H_2O(80:10:10)$ and subsequent measurement of color density of Sr complex with o-cresolphthalein complexone was used. (D.C.W.)

25068 DEVELOPMENT AND CLINICAL ASPECTS OF A NEW METHOD FOR SELECTIVE DEPOSITION OF RADIOACTIVITY IN MALIGNANT TUMORS. C. Winkler (Universität, Bonn). Med. Klin. (Munich), 58: 1294-6 (Aug. 9, 1963). (In German)

In rats intravenously injected with fibrinogen labeled with ^{131}I, the radioisotope was concentrated in liver, thyroid, and tumors. Thyroid deposition was probably due to release of free I, because it is prevented by pretreatment of the animals with perchlorate. Liver deposition was almost nil after 12 to 60 hr. Scintigraphic measurements showed high concentrations in implanted Yoshida sarcomas. Spontaneous tumors did not concentrate as much radioactivity, and so this method may not be effective treatment for tumors in humans. These differences may be due to reduced activation of the coagulation system or to enzymatic activity that prevents fibrin accumulation. Slowly growing spontaneous tumors have a less active plasmin system than implanted tumors, but after x irradiation they concentrate more radioactive fibrinogen. Fibrin formation may be increased in spontaneous tumors by increased enzyme activity. To measure effects of fibrinolysis on the retention of labeled fibrin in tumors a fibrinolysin inhibitor, ε-amino = caproic acid, was used. This acts either as a plasminogen activator or on the plasmin itself. The amount and intratumor rentention time of the fibrin was increased very much, suggesting that accelerated fibrinolysis is responsible for the lesser radioactivity observed in spontaneous tumors. The results suggest that a tumor should be preirradiated, labeled fibrinogen or fibrin antibodies injected, and fibrinolysis should be reduced by plasmin inhibitors. Calculations from experimental results of this combined procedure, where fibrinogen labeled with ^{131}I was used in rats, show that the deposition in Yoshida sarcomas was sufficient for a tumoricidal dose of 3000 r, with 320 r to liver, and 180 r of whole-body radiation. Results with spontaneous tumors are being studied at present. (BBB)

25069 DOSE-EFFECT MEASUREMENTS OF RADIATION FOLLOWING ADMINISTRATION OF TRITIATED THYMIDINE. W. E. Kisieleski, L. D. Samuels, and P. C. Hiley (Argonne National Lab., Ill.). Nature, 202: 458-9 (May 2, 1964).

Methods of estimating radiation dose were examined, and a dose-effect relation was obtained at the cellular level. CF1 mice were injected with various doses of tritiated thymidine or sterile saline. Testes were removed from animals killed at regular time intervals after injection. Radioautographs of testes sections and histological evaluations of radiation damage were made. Radioautographs demonstrate a labeling almost solely of primary spermatocytes, with the labeling index unchanged throughout the range of doses of administered tritiated thymidine. Among the significant cytological effects seen, the most notable is the decrease in spermatocytes seen in the 50 μC/g group between two and four days. Calculation of rad dose to the cell nuclei from 125 disintegrations, assuming a 4.2-μ diameter nucleus of mass 3.84×10^{-11} g and an average tritium beta-energy of 0.006 Mev, yields a dose of about 300 rads/cell. (H.M.G.)

25070 MEASUREMENT OF REGIONAL BLOOD FLOW THROUGH THE SKIN FROM THE CLEARANCE OF KRYPTON-85. G. Bell (Glasgow Univ.) and A. Murray Harper. Nature, 202: 704-5(May 16, 1964).

A technique for the measurement of the blood flow through the skin adapted from a method devised by Lassen and Ingvar is presented. Krypton-85 dissolved in saline was injected into the femoral artery of mongrel dogs. Following the injection, blood flow was calculated from the rate of isotope clearance. Skin blood flow remained reasonably constant in each individual dog. Advantages and disadvantages of the technique are discussed. (H.M.G.)

25071 A CONTRIBUTION TO THE PROBLEM OF INTRAPERITIONEAL APPLICATION OF RADIOGOLD ^{198}Au. V. Vebersík (Charles Univ., Prague). Neoplasma, 11: 207-22(1964).

A study was made of the dosimetric conditions of intraperitoneal applications of radiogold ^{198}Au in the abdominal cavity, in the rectum, vagina, urinary bladder, and the activity of blood and urine, the effect of the ionizing radiation on the formation af ascitic fluid, and the rate of fixation of colloidal particles of radiogold on the peritoneum. (auth)

25072 IRON-59 ABSORPTION MEASUREMENTS BY WHOLE-BODY COUNTING AND FAECAL RECOVERY TECHNIQUES. A STUDY OF EXPERIMENTAL ERRORS. Bo Lindell, O. Strandberg, and Peter Reizenstein (Karol-

inska Sjukhuset, Stockholm). Phys. Med. Biol., 9: 189-201(Apr. 1964).

An assessment has been made of the types and magnitudes of errors involved in ^{59}Fe intestinal absorption measurements by whole-body counting, employing a stationary single-crystal arrangement with the patient sitting on a chair in a simple open booth of shielding iron. The counting-statistical variation and the errors due to different positioning were found to be relatively minor, the major source of error being changes in counting efficiency caused by redistribution of the activity within the body. The total standard deviation due to random variation was found to be about 10%. A comparison with data based on fecal collection did not reveal any large systematic errors, but indicated a possible trend of too high retention values from whole-body counting as compared with the results derived from measurements of feces; this error, however, did not exceed 20%, and might partly be explained by an overestimation of the retention as obtained from the fecal collection data. (auth)

25073 METABOLISM OF STRONTIUM IN ADULT HUMANS. T. Domański and J. Liniecki (Inst. of Occupational Medicine, Łódź, Poland). Phys. Med. Biol., 9: 229-31(Apr. 1964).

A model of Sr turnover is compared with ^{90}Sr dosimetry for the evaluation of the hazards from the chronic intake of ^{90}Sr from fallout by man. Available data on the ^{90}Sr content in the diet and bones of adults and data on Ca and Sr metabolism in man were used for the calculations. (C.H.)

25074 THE SIMILAR ACTION OF LYSERGIC ACID DERIVATIVES, HYPERTENSIN (CIBA), AND ALDOSTERONE UPON ^{86}Rb UPTAKE BY RED BLOOD CELLS FROM CONTROL AND CANCER SUBJECTS. K. G. Scott and A. E. Daniels (Univ. of California, San Francisco). Proc. Western Pharmacol. Soc., 6: 42(1963).

Studies with rats bearing transmissible fibrosarcomas showed that their red blood cells (RBC) take up ^{86}Rb at a slower rate than RBC from normal rats. RBC from tumor-bearing rats suspended in plasma from normal rats exhibit the same decreased rate of ^{86}Rb uptake indicating that the defect resides in the cell. Similar and more marked results have been obtained on human subjects bearing one of the following tumors: adenocarcinoma, squamous cell carcinoma, lymphoma, lymphosarcoma, and in most other types tested. The rat fibrosarcoma is known to liberate the histamine and 5-hydroxytryptamine (5-HT) stored in the hosts mast cells and both of these amines are proven cell membrane dilators. The addition of either a 5-HT and histamine blocker, SA-97 (N-chlorobenzhydryl-N'-methyl-homopiperazine), or a 5-HT blocker, BOL (d-2-bromlysergic acid diethylamide), to the blood of cancer subjects, whether human or rat, remedies the defect and returns the ^{86}Rb accumulation rate to normal. These compounds have little, if any, effect on normal cells. Therapy or surgical removal lowers the prolonged uptake of ^{86}Rb by the cell and this type of test may be an index to the efficacy of therapy. In a search for natural metabolites in the body which may block, regulate, or control the action of histamine and 5-HT on cell permeability, studies with hypertensin and aldosterone were conducted. These compounds were chosen because of the increased plasma α_2-globulin and potassium levels proven in both rat and human cancer, and the reduced kidney clearance of such halides as iodide in these subjects. These data suggest that the succeeding metabolites of the α_2-globulin, angiotensin (similar to hypertensin except for the N-terminal amino acid), and aldosterone, which regulates plasma potassium, may be involved. In the rate, both hypertensin and aldosterone significantly shorten ^{86}Rb uptake in a manner similar to BOL or SA-97. In 10 patients with cancer, hypertensin was as effective as in the rat. (BBB)

25075 EXPERIMENTAL RESEARCH ON THE INTRODUCTION INTO THE PORTAL VEIN OF A NEW COLLOIDAL COMPLEX LABELED WITH P-32. Leonardo Caldarola, Fausto Badellino, Adalberto Cavalli, Paolo Calderini, Bartolomeo Bellion, Umberto Rosa, and Saudo Sosi (Ospedale di S. Giovanni, Turin). Tumori, 49: 29-37(Jan.-Feb. 1963). (In Italian)

A new ^{32}P-labeled colloid, prepared as described by Bellion, et al. (Minerva Nucl., 6: 199(1962)), was injected into the portal vein of rabbits, and its tissue distribution was determined autoradiographically. Results showed that this ^{32}P-labeled colloid is very stable, in the liver for periods of over two months. This is in contrast to the colloidal radiogold, which is less effective in irradiating the liver. The ^{32}P colloid was distributed almost uniformly throughout the liver lobules, with smaller amounts in interstitial tissue. (BBB)

25076 RECOGNITION AND CLINICAL IMPORTANCE OF THORIUM DIOXIDE (THOROTRAST®) DEPOSITS IN HUMAN UNSTAINED BONE MARROW SMEARS. Stuart C. Finch (Yale Univ., New Haven). Yale J. Biol. Med., 36: 388-95(Apr. 1964).

The case histories of three patients with prominent deposits of ThO_2 (Thorotrast) in their unstained bone marrow aspiration smears are presented. The importance of differentiating hemosiderin and Thorotrast in bone marrow smears is discussed. (auth)

25077 THE CHEMICAL SYNTHESIS AND BIOLOGICAL FATE OF TRITIUM LABELED LINOLEIC ACID. Demetrois Spyridon Sgoutas. Thesis, Urbana, Ill., Univ. of Illinois, 1963. 117p.

Tritium labeled linoleic acid with a specific activity of 357 mC/mmole was obtained in 65% from octadeca-9,12-diynoic acid. A source of 1 curie of tritium diluted with hydrogen was used to semi-hydrogenate this acid in the presence of Lindlar catalyst. The diacetylenic acid was obtained by condensing 1-bromo-oct-2-yne and 9-undecynoic acid in tetrahydrofuran with cuprous cyanide as catalyst. 1-Bromo-oct-2-yne was prepared as follows:

$$CH_3\ (CH_2)_3\ CH_2Br \rightarrow CH_3\ (CH_2)_4\ C \equiv CH \rightarrow CH_3$$
$$(CH_2)_4\ C \equiv C\text{-}CH_2OH \rightarrow CH_3\ (CH_2)_3\ C \equiv C\text{-}CH_2Br$$

9-Undecynoic acid was derived from the methyl ester of 10-undecylenic acid through the Barbier-Wieland degradation. Chemical and radiochemical purity of tritium labeled linoleic acid was assessed by chromatographic methods. Chromatography on silica gel impregnated with silver nitrate indicated that only traces of the trans isomer were formed under the conditions employed for the reduction. Evidence from mild oxidative cleavage indicated that the radioactive tag was located at the position of the olefinic bonds and only negligible substitution of hydrogen had occurred. Tritium appeared to adhere firmly to the linoleic acid molecule under chemical and biological manipulations. In a preliminary study two groups of chicks were fed diets rich in unsaturated or saturated fat respectively and a third group was fed a fat-free diet. Evidence was observed that the diet could influence the fatty acid composition of the liver fat and the assumption was made that this alteration would reflect an adjustment to the diet of the enzyme responsible for the metabolism of fatty acids in the experimental animals. A mixture of methyl linole-

ate-^{3}H and methyl linoleate-^{14}C was fed and by following the distribution of tritium content together with the carbon-14 data differences in the metabolism of linoleic acid among the three groups of animals were observed. The linoleic acid content of the liver fat increased in all cases, the highest increase was observed in the animals fed the fat-free diet. In addition linoleic acid was retained for longer period of time in animals on the fat-free diet than in those fed corn oil. No sparing effect in deficient animals was indicated, but judging from the activity of the acetate pool, it appeared that all animals oxidatively degraded linoleic acid. The most evident conversion of linoleic acid to other fatty acids involved arachidonic acid. By calculation of the activities of the two labels in the arachidonic acid certain estimations of the amount of intact linoleic acid participating were made. More carbon-14 radioactivity was incorporated into palmitic acid than into stearic and oleic acids and occurred equally well in all dietary groups. The same was true for tritium activity except in the case of the corn oil fed animals tritium activity together with carbon-14 data indicated a higher content of tritium in stearic and oleic acids. This finding was explained by assuming that a biohydrogenation mechanism operated at a low order in response to the enrichment of the diet in the test compound. (Dissertation Abstr.)

25078 CRITICAL CONTROLLED INHALATION STUDY OF PATHOGENESIS OF NEODYMIUM OXIDE IN MICE AND GUINEA PIGS. Frederick Corbet Davison. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 159p.

This experiment was designed to evaluate the effects of an aerosol of stable neodymium oxide (Nd_2O_3) of a known particle size range and concentration on the lungs, other major organs, blood, and body weight of mice and guinea pigs when administered over various periods of time up to 120 days. In order to accomplish this, an inhalation system was constructed, and the aerosol produced was characterized concerning its particle size and concentration. The final experimental design was the outgrowth of a pilot intratracheal injection experiment conducted on guinea pigs and rats. Mice and guinea pigs exposed to concentrations of approximately 30 mg Nd_2O_3/meter^3 of air, in which about 60 per cent of the mass was composed of particles less than 1μ in diameter, showed a gradual increase of neodymium in the lung as exposure time increased. This material was contained in macrophages in the alveoli and in the alveolar septa and was transported to the tracheobronchial lymph nodes. There were no granulomatous or other dramatic inflammatory reactions to the foreign material during the period of this experiment, and the other body organs which were evaluated histopathologically remained relatively normal. Changes in hematologic parameters were not remarkable. (Dissertation Abstr.)

25079 THE RELATIVE DISTRIBUTION OF MULTIPLE RADIONUCLIDES IN A FRESH-WATER POND. William Aloysius Brungs, Jr. Thesis, Columbus, Ohio, Ohio State Univ., 1963. 97p.

A plastic-lined pond containing 30,000 gallons of spring water and a sand substrate was used for this study. The test organisms were carp, Cyprinus carpio; bluegills, Lepomis macrochirus; snails, Vivipara malleatus; tadpoles of the bullfrog, Rana catesbiana; and two species of clams, Anodonta grandis, a thin-shelled species, and Lampsilis radiata siloquoidea, a thick-shelled species. Water and substrate samples were also collected and analyzed. Four millicuries each of cobalt-60, zinc-65, strontium-85, and cesium-137 were added to the pond water several weeks after the test organisms had been introduced. Samples for baseline radiological data were collected several days before the start of the experiment, after which 10 complete sets of samples were collected over an 80-day period. During the experiment numerous chemical, physical, and biological analyses were performed on the experimental pond water and also on a control pond. This information provided an indication of differences between the two pond waters. There was an initial rapid loss of cobalt-60, zinc-65, and cesium-137 from solution. Cobalt-60 and zinc-65 were becoming associated with the suspended solids and cesium-137 was adsorbed onto the bottom sediments. Strontium-85 was gradually removed from solution. Only 8 percent of the cobalt-60, 4 percent of the zinc-65, and 5 percent of the cesium-137 remained in solution after 4 days. Sixty-four percent of the strontium-85 was in solution at this time. More zinc-65 was found in biological samples than any of the other test radionuclides except in some hard parts fractions such as shell and bone in which strontium-85 activities were generally higher. The primary consumers, carp, snails, tadpoles, and clams, accumulated more of each radionuclide than did the predatory bluegill. In general, soft parts rapidly accumulated more activity than the hard parts but gradually lost it as radionuclide concentrations in the water decreased. Clam and snail shells and fish bone generally accumulated zinc-65 and strontium-85 for almost the duration of the experiment. Carp, snails, and clams remaining after the final sampling from the pond were placed in continuously replenished, uncontaminated water for 3 weeks, but no detectable radionuclide loss was observed. During this time the water temperature was low, about 15°C less than during the experiment, and the metabolic activity of these test organisms was greatly reduced and any loss of radionuclides would, as a result, be inhibited. Young clams and snails accumulated more zinc-65 and strontium-85 than did adult individuals of these two groups. However, strontium-85 concentrations in the soft parts of clams were higher in the adults. (Dissertation Abstr.)

Radiation Effects

25080 (AHSB(RP)R-39(p.11-19)) BIOLOGICAL EFFECTS OF RADIATION ON THE SKIN—EARLY EFFECTS. A. M. Jelliffe (Middlesex Hospital. Courtauld Inst. of Biochemistry, London).

The effects of ionizing radiation upon skin depend on dose, dose rate and fractionation, and type of radiation. Considerable variation is seen in the reaction of the skin to ionizing radiation. Early reactions depend on the effects on both the basal epithermal layers and on the small blood vessels. Later effects, such as delayed healing and necrosis, are related to blood vessel changes. These effects vary with the penetration of the radiation, the thickness of the skin, and other less important factors such as age, nutritional condition, sex, and hormonal factors. It is pointed out that skin reactions should not be allowed to limit the therapeutic use of radiation in cancer patients. (C.H.)

25081 (AHSB(RP)R-39(p.21-9)) BIOLOGICAL EFFECTS OF RADIATION ON THE SKIN—LATE EFFECTS. E. V. Hulse (Gt. Brit. Medical Research Council. Radiobiological Research Unit, Harwell, Berks, England).

Radiation can produce both malignant and non-malignant skin tumors arising from either the epidermis or the dermis. Radioinduced benign tumors may later become malignant. Although cases of radioinduced skin cancers with

very short latent periods have been reported, it is more usual for there to be an interval of many years between irradiation and the appearance of a cancer. There is also evidence that cancers can develop when the skin reaction is not severe and that dose fractionation does not always reduce tumor incidence. It is pointed out that when assessing the incidence of tumors after a particular dose it is very important to consider the area of skin that was irradiated. Data are included on the incidence of skin tumors in mice exposed to various doses of β radiation from external sources. (C.H.)

25082 (AHSB(RP)R-39(p.31-43)) MEASUREMENT AND ASSESSMENT OF SKIN DOSES—FROM EXTERNAL RADIATION. T. F. Johns (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England).

Difficulties in assessing and measuring skin doses from external radiation are reviewed. It is pointed out that dosimetry of the skin differs from that of the soft tissues of the rest of the body since very significant doses can arise from easily absorbed radiations such as β particles and soft x rays and, in many cases, the incident radiation has by no means produced electronic equilibrium with the environment with the result that there is a build-up of dose with depth in the body in the first few millimeters or centimeters in which case the dose to the skin may be lower than that in tissues just below the skin. Maximum permissible levels of skin exposure and basic features of skin dosimetry are discussed. (C.H.)

25083 (AHSB(RP)R-39(p.44-68)) MEASUREMENT AND ASSESSMENT OF SKIN DOSES—FROM SKIN CONTAMINATION. G. R. Newbery (Gt. Brit. Radiochemical Centre, Amersham, Bucks, England).

The measurement of radiation doses to skin after the occurrence of a contamination accident depends on how much activity was on the skin, on how long the skin was exposed, on the extent to which the radiation penetrated the skin surface, on the nuclides involved and the characteristics of their particulate radiation, and on the depth at which the tissue dose is assessed. It is pointed out that the practical requirement is to relate the observed counting rate at the surface of the skin with the dose rate, usually at the basal layer. Such relations are derived for three typical nuclides: ^{14}C, a pure β emitter of low energy; ^{32}P, a pure β emitter of high energy; and ^{239}Pu, an α emitter. Calculations are included. (C.H.)

25084 (NYO-2568-1) THE EFFECT OF X-RAY IRRADIATION ON THE DESOXYRIBONUCLEIC ACIDS OF THE SPLEEN AND RADIOSENSITIVE TISSUE. Final Summary Report. Henry P. Schwarz (Philadelphia General Hospital). May 30, 1964. Contract AT(30-1)-2568. 17p.

Whole-body x irradiation of rats produced definite changes of the chromatographic profiles from cellular columns of spleen DNA. X irradiation also caused changes in electrometric titration values of unseparated DNA's and changes in infrared intensities of unseparated DNA's and chromatographic DNA fractions. Possible molecular and biological significance of these findings are discussed. (C.H.)

25085 (SGAE-BL-5/1964) UNTERSUCHUNGEN VON FRUHSCHÄDEN IN ZELLEN NACH IONISIERENDER BESTRAHLUNG. II. IN VITRO VERSUCHE ÜBER DEN ABBAU VON NUKLEINSAUREN VERSCHIEDENEN SPURENELEMENTGEHALTES DURCH NUKLEASEN. (Study of Early Damage in Cells After Ionizing Radiation. II. In Vitro Experiments on the Decomposition of Nucleic Acids with Various Trace Element Contents by Nuclease). G. Stehlik, H. Altmann, and K. Kaindl (Österreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf, Austria). [1963]. 12p.

The influence of metal ions bound in nucleic acid on nuclease decomposition was investigated. It could be shown that these metal ions exhibit a strong protective effect against the nuclease. The trace element cleavage caused by ionizing radiation of ribonucleic acid facilitated the ribonuclease attack. Irradiated desoxyribonucleic acid was more badly decomposed, on the other hand, by desoxyribonuclease. Nevertheless, additions of copper ions showed a similar inhibition effect as for the ribonucleic acid. (tr-auth)

25086 (TID-20636) STUDIES ON BIOLOGICALLY ACTIVE AMINES. Annual Progress Report, August 1, 1963—May 30, 1964. Yutaka Kobayashi (Worcester Foundation for Experimental Biology, Shrewsbury, Mass.). June 3, 1964. Contract AT(30-1)-2085. 9p.

A procedure is described for the assay of monoamine oxidase in blood plasma. The plasma diamine oxidase level was found to increase by the 6th week of pregnancy and remain elevated until 10 to 14 days after parturition. Data are included from studies of plasma diamine oxidase titers of normal and pregnant rats, the effects of x radiation on stomach histidine decarboxylase activity in rats, the purification of diamine oxidase, and the plasma monoamine oxidase levels in the blood of normal and stressed human subjects. (C.H.)

25087 (TID-20641) AGING EFFECT OF IONIZING RADIATIONS AND ITS RELATIONSHIPS TO ATHEROSCLEROSIS AND LIPID METABOLISM. Camillo Artom (Wake Forest Coll., Winston-Salem, N. C. Bowman Gray School of Medicine). May 15, 1964. Contract AT(40-1)-2794. 32p.

The effects of radiation on the development of atherosclerosis was investigated in White Carneaux and Show Racer strains of pigeons. The effects of irradiation on resistance to atherosclerosis exhibited by some strains of pigeons and the effects of dietary cholesterol on the development of atherosclerosis were also investigated. The experiments were carried out in atherosclerosis susceptible and resistant pigeons fed a commercial grain diet and in those fed a special diet with 1 or 0.1% cholesterol added. Pigeons from each group were exposed to 3000 to 6500 r x or γ radiation given in 10 to 14 sessions at 2-week intervals. The pigeons were killed at various time intervals, and the aortas and hearts were examined macroscopically and histologically for atherosclerotic lesions. Livers and aortas were also used for incubation or perfusion studies. Blood was analyzed for serum lipids, hemoglobin, and cell volume changes. Phosphorus-32 was injected as an internal radiation source in some studies, and lipid synthesis was measured in isolated prefused aortas and in liver slices using acetate-1-^{14}C as a tracer. Results indicate that neither external nor internal radiation exposure at the doses used had any effect on the development of atherosclerosis in White Carneaux pigeons. Pigeons of the Show Racer strain developed a high incidence of atherosclerotic lesions of the aorta and coronary arteries when fed a diet containing 1% cholesterol. The incidence of atherosclerotic lesions in this strain was greater in irradiated than in control birds. (C.H.)

25088 (UCD-472-109) LONG TERM EFFECTS OF X RADIATION ON THE BEAGLE. Annual Progress Report No. 13. A. C. Andersen (California. Univ., Davis. School of Veterinary Medicine). June 1964. Contract AT(04-3)-472. 183p.

Separate abstracts were prepared on six sections of this report. (C.H.)

For abstracts of individual sections see: 25089, 25090, 25091, 25092, 25093, and 25094.

25089 (UCD-472-109(p.18-44)) PRESENT STATUS OF THE EXPERIMENTAL COLONY. R. M. Johnson (California. Univ., Davis. School of Veterinary Medicine).

The 1963 annual examination disclosed relatively few major changes in the status of 11-yr-old beagles exposed during their youth to single doses of 100 or 300 r x radiation. The general condition of the colony remained good. Obesity was not a severe problem. There was an increase in graying of the legs, but not in generalized graying. The incidence of hyperkeratosis in localized skin regions remained, but it was not accompanied by severe inflammation. There was an actual decrease in otitis externa. Wearing of teeth was seen in the incisors and molars. Cardiovascular disease was slightly increased, from 6% the previous year to 9%. Of greatest significance was an increase in mammary gland nodules or tumors. (C.H.)

25090 (UCD-472-109(p.45-8)) OPHTHALMOSCOPIC FINDINGS IN EXPERIMENTAL DOGS. W. G. Magrane (California. Univ., Davis. School of Veterinary Medicine).

Four years of gross and ophthalmoscopic examinations of x-irradiated and control beagles revealed the following conditions: corneal opacities, cataracts, vitreous bodies (synchysis), and retinal degeneration. Of the 228 dogs examined in 1963, 125 (55%) showed no eye lesions. Lesions were distributed rather uniformly among experimental groups (control, 100 r, and 300 r). The age range was 2690 to 4679 days. There was no evidence of radioinduced ocular lesions. (auth)

25091 (UCD-472-109(p.49-52)) SIX PSYCHOLOGICAL FIELD STUDIES ON IRRADIATED ADULT FEMALE BEAGLES: STATUS REPORT. A. K. Solarz (California. Univ., Davis. School of Veterinary Medicine).

Results are reported from six psychological field studies conducted during 1963 on aging irradiated female beagles. The studies included dominance-submission relations between paired dogs; emotional response as determined by friendliness, wariness, and aggressiveness toward man; learning measurements when food was used as a reward; observations on curiosity behavior; and observations of atypical behavior, including anxiety neurosis and hallucinatory experiences. (C.H.)

25092 (UCD-472-109(p.53-61)) THE EFFECT OF X IRRADIATION ON REPRODUCTION OF FEMALE BEAGLES. A. C. Andersen (California. Univ., Davis. School of Veterinary Medicine).

A single near median lethal roentgen-ray exposure to female dogs failed to impair reproduction. Reproductive capacity in both control and irradiated dogs was maximum at 1250 days (3.4 yr) of age, declining thereafter. Pups irradiated during follicular maturation were likewise not affected in reproductive capacity. The conclusion is that the reproductive capacity of this species is not seriously affected by a single whole-body x ray exposure. (auth)

25093 (UCD-472-109(p.62-172)) PATHOLOGY REPORT ON EXPERIMENTAL BEAGLES. A. C. Andersen and R. M. Johnson (California. Univ., Davis., School of Veterinary Medicine).

Summaries are presented of clinical and autopsy data on dogs from an irradiated colony that died between Feb. 1963 and Feb. 1964. The case history of each dog is reviewed from the individual master file record and IBM tabulations. The dogs were exposed to doses of 100 or 300 r x radiation in 1952. Neoplasms were the cause of death in the majority of cases with carcinomas of the reproductive or respiratory systems accounting for 88% of the 35 fatalities reported. (C.H.)

25094 (UCD-472-109(p.173-7)) SURVIVAL OF X-IRRADIATED BEAGLES. Leon Rosenblatt and A. C. Andersen (California. Univ., Davis. School of Veterinary Medicine).

Probability of survival (P_x) and the standard error (s_x) were determined for 14 x-irradiated subgroups of beagles and their sham controls. Survival of controls and of dogs exposed to 100 r compared favorably until nine yr of age, but for dogs exposed to 300 r was consistently lower (5 to 10%). At 10 yr of age, P_x was 70% for controls. For the 100 r group, 62% and 38% for the 300 r group. Decrease in survival with advancing age was largely due to neoplasms. (auth)

25095 (FTD-TT-63-1046) SOME RESULTS OF THE STUDY OF THE BIOLOGICAL EFFECT OF NEUTRONS AND PROTONS. Translation of "Nekotoryye Itogi Izucheniya Biologicheskogo Deystviya Neytronov i Protonov" from Report SM-44/54. 1963. 24p.

On the basis of existing literature, it is impossible to give the complete characteristics of the biological effect of neutrons. Radiobiology has accumulated complex testimony which allows us to judge the RBE of protons and neutrons and is compiling data which point to the necessity of a careful study on a wider scale. Obtaining such data will make it possible to analyze the characteristics of the regenerative processes, the correlation and rhythm of the injury, regeneration and compensation processes, and thereby even to specify the characteristics and regularities of the course of radiation injury and its results when neutrons and protons of various energies are used. Many problems of the biological effect of neutrons and protons are far from solved. The range of energies studied is insufficient; there has also been little work done on large animals, on remote sequelae, and on protection from and therapy of injury caused by neutrons and protons. (auth)

25096 (JPRS-24896) CAUSE OF THE DECREASE IN THE NATURAL RESISTANCE OF IRRADIATED ANIMALS TO LIVE BRUCELLOSIS VACCINE. Z. V. Shevtsova. Translated from Zh. Mikrobiol. Epidemiol. i Immunobiol., 42: No. 4, 100-5(Apr. 1964). 8p. (OTS-64-31389)

An increase in mortality of guinea pigs was observed when x-irradiated animals were given a live or heat-killed vaccine culture of Brucella or the endotoxin extracted from it. The extent to which the animals were infested with Brucella of the vaccine strain did not increase and the residual virulence of the microbes was not intensified. An increase in sensitivity of Brucella endotoxin played the leading role in reducing the resistance of irradiated animals to vaccine of strain Br. abortus No. 19-BA. (auth)

25097 (JPRS-24936) COURSE OF ASEPTIC INFLAMMATION OF THE CORNEA UNDER THE INFLUENCE OF β PARTICLES FROM RADIOACTIVE THALLIUM (Tl^{204}). S. D. Denisyuk. Translated from Med. Radiol., 9: No. 4, 41-6(Apr. 1964). 8p. (OTS-64-31409)

The use of small doses of ^{204}Tl radiation is an effective method of treating aseptic inflammation of the rabbit cornea induced by injection of an emulsion of gelatine with turpentine into the cornea. Irradiation in single doses of 50 and 75 rad at intervals of 48 hr yields better results

than daily irradiation in single doses of 25 rad. The total dose in 50-rad irradiation is the least, although the duration of the healing period is somewhat greater for this method than in irradiation with individual doses of 75 rad. Irradiation of the cornea with ^{204}Tl had no influence on the qualitative and quantitative composition of the blood within the individual at the total dose limits used. The curtailment of the period of emigration of leukocytes and cast-off epithelium under the influence of irradiation indicates the anti-inflammatory action of ^{204}Tl. The small depth to which ^{204}Tl radiation penetrates in tissue, the relatively long half life of this isotope, and its effectiveness when used for experimental inflammation of the cornea made it possible to test this treatment method clinically for inflammatory diseases of the anterior portion of the eye. (auth)

25098 THE EFFECT OF 15-Mev ELECTRON RAYS ON THE ACTIVITY AND EXCITABILITY OF THE ISOLATED FROG HEART. Jozsef Tigyi (Inst. of Biophysics, Pecs, Hungary). Acta Physiol. Acad. Sci. Hung., 24: 129-35(1963).

Betatron radiation, varying in energy from 3 to 16 Mev and up to a maximum dose rate of 500 rad/min, was applied to the Rana esculenta heart, stopped in vitro by addition of K-rich solution. In a second experiment cardiac arrest was achieved by ligation of the atrioventricular border and the threshold stimulus voltage of the arrested ventricles was examined with single condenser discharges. In the first test, the hearts were maintained in normal Ringer solution for 30 to 60 min; then normal Ringer solution was replaced by a K-rich solution, the action of the heart being registered continuously. Full arrest ensued after 3 to 5 systoles; after 60 sec the β radiation was applied, and after 60 sec the K-rich solution was exchanged for normal Ringer solution. The experiments were repeated 4 to 5 times. Total restitution of heart action was never observed. The restored amplitude was, at the most, half, and the frequency about $^1/_5$, of the original values. After the beginning of irradiation the arrested heart reacted with a latency period of a few seconds, and after the cessation of irradiation 1 to 2 systoles could be observed in a few cases. The majority (99%) of the frog hearts arrested by this method did not visibly react to external β irradiation of such energy and intensity as was used. The few equivocally positive experiments indicate that external β radiation may affect the action of the heart. The positive experiments were invariably observed with 16-Mev irradiation but this does not mean that irradiation with higher energy is more effective than with lower energy, because the maximum dose rate at 15 Mev is 500 rad/min and at 3 Mev only about $^1/_{10}$ of that. Thus, it was not possible to draw conclusions as to energy dependence. In the second experiment, attempts were made to determine whether other changes in the properties of the isolated frog heart could be observed in response to irradiation. In related experiments it was found that the excitability of skeletal muscles irradiated with $^{90}Sr-^{90}Y$ changes significantly after relatively small doses; therefore, the influence of betatron irradiation on excitability of the heart ventricle was studied. In most experiments with the heart stopped by atrioventricular ligation, 15-Mev β irradiation (70 rad) decreased the threshold of the ventricles to electrical stimulation. In about $^1/_3$ of the experiments, irradiation did not affect excitability of the heart. (BBB)

25099 OBSERVATIONS ON PIGEONS WITH PRETHALAMIC RADIOLESIONS IN THE NERVOUS PATHWAYS FROM THE TELENCEPHALON. Bengt Akerman, Eric Fabricius, Borje Larsson, and Lennart Steen (Univ. of Stockholm). Acta Physiol. Scand., 56: 286-98(1963).

Effects of localized high-energy proton irradiation of the brain of Columbia livia are described. The 185-Mev proton beam produced by the 230-cm Uppsala synchrocyclotron was used to deliver a 30-krad dose at a rate of 1 to 3 krad/min. Lesions were produced in the cerebral peduncles and the septal region at a level in front of the anterior commissure, without apparent damage to diencephalic structures. The behavior of the birds following the procedure was observed. Spontaneous eating, drinking, and flying, escape responses, and all social behavior disappeared during the first four days after irradiation in pigeons in which all connections from the cerebral hemispheres were destroyed. On the contrary, swallowing, blinking, and pupillary reflexes as well as the muscular and visual control of standing, walking, and flying remained. In other pigeons with small, caudal parts of the peduncles intact, similar behavior changes were observed, but no pattern of behavior disappeared until after five days or more. In a third group of pigeons in which only more anterior parts of the peduncles were transected, no behavioral changes were observed. The experiments demonstrate that delayed, circumscribed destruction of cerebral structures by ionizing radiation may be used to particular advantage in the study of the anatomical foundation of animal behavior. (BBB)

25100 ALTERATIONS IN PHYSIOLOGICAL ACCOMMODATION TO STRESS INDUCED BY IRRADIATION. Bernard D. Newsom and Donald J. Kimeldorf (General Atomics Div., General Dynamics Corp., San Diego, Calif.). Aerospace Med., 34: 226-30(Mar. 1963).

The effect of neutron irradiation (in a 60-in. cyclotron by bombardment of Be with protons, giving an energy spectrum of fission neutrons) on cold-stressed rats was studied and the results compared with previous related x-ray studies. In the first experiment with a maximum sublethal dose the rats were exposed to 220 rad of neutrons and then placed in the cold (−20°C) at various times during the 30 days of the postirradiation period; no irradiation deaths occurred in the 30-day group. A significant decrease in mean survival time of irradiated rats occurred on day one and remained below that of the controls for all tests during the 30 days postirradiation. The heart rate of rats following bombardment with 230 rad of neutrons was compared to that of nonirradiated rats. On the third day postirradiation both groups responded to the cold with an increased heart rate; control heart rates remained elevated but the heart rate of irradiated rats soon decreased, falling below baseline measurements. In irradiated rats there was a greater rate of body temperature fall during cold exposure following the irradiation. This difference persisted through the 9th day, then disappeared. Respiration rate did not differ between irradiated and nonirradiated rats. Blood pressure was lower in irradiated rats. By exposing rats from three different age groups (78, 340, and 662 days) simultaneously to −20°C, the body weight factor was analyzed. Results indicated that survival time was not correlated with body weight, although the older and and heavier rats had a shorter mean survival time than either the younger and light animals. The body temperature of the irradiated rats did not decrease at a faster rate than controls nor was it higher at death in the irradiated rats or in the older animals with short survival times. Survival appeared to depend on the ability to maintain temperature above a certain minimum value below which the decrease was precipitous. The response of neutron-

irradiated rats during the first two weeks was similar to that of x-irradiated rats after about one-half the rad dose of x rays; the effect persisted 30 days after exposure, but the x-irradiated animals recovered their cold tolerance prior to the 22nd day. The applicability of these results to radiation problems expected in manned space vehicles is discussed, and it is concluded that more information is required about the effects of particulate radiation on performance and stress resistance in primates before a meaningful design limit can be made for tolerable crew irradiation during space flight. (BBB)

25101 THE INDIRECT EFFECT OF SHORT-DISTANCE X-RAY IRRADIATION ON THE MITOTIC ACTIVITY IN SOME ORGANS OF RATS. A. Voutilainen (Univ. of Helsinki). Ann. Med. Exptl. Biol. Fenniae (Helsinki), 39: 329-33(1961).

To determine whether local, skin irradiation affects unirradiated organs, Sprague-Dawley rats were exposed to 60-kv x rays over an area of 2 cm^2 (interscapular skin fold, pulled away from the body during exposure) in three single doses of 1000 r each. The mitotic activity in the outer orbital gland and liver was the same in the irradiated and control groups 6 hr to 7 days later. The mitotic index of the forestomach and the glandular stomach after 12 hr was higher than in the control group, but not significantly so. No fluctuations were noted in the mitotic index of the trachea, but in the esophagus it fell significantly in the irradiated group after 6 hr. The clearest differences in the mitotic index after irradiation were in the small and large intestine. Compared with the controls, the counts in the small intestine after two days were higher in the irradiated animals and after 7 days lower. In the large intestine they were higher in the irradiated group after 6 hr and lower after two days. Changes in mitotic index in the esophagus of the irradiated group were regarded as a direct irradiation effect, since, according to measurements, the esophagus received about 30% of the dose given to the skin, 900 r. The postirradiation variations in the mitotic index in untreated areas of the skin were small. Significant change was established only in organs which gave the highest mitotic index and in which cells regenerate rapidly. The observed low mitotic counts in the small and large intestine after x irradiation are regarded as an indirect and distant action of irradiation transmitted humorally. They were not regarded as a direct effect on the intestine since this region was protected with lead and the scattered dose in the abdomen was only 5 to 8 mr at a skin dose of 1000 r, according to the measurements that were made. (BBB)

25102 STUDY OF CHANGES OF DEOXYRIBONUCLEIC ACID IN THE LATEROCERVICAL LYMPH NODES OF GUINEA PIGS SUBJECTED TO FRACTIONATED DOSES OF X RADIATION AND EXAMINED AFTER A PERIOD OF TIME. A. V. Boriani, A. Trenta, and G. Aliprandi (Università, Milan). Arch. Ital. Otol. Rinol. Laringol., 73: 384-400(May-June 1962). (In Italian)

Cytological and histochemical studies were made of the lymph nodes, situated along the tracheas of guinea pigs, 15 and 30 days after local doses of 200-kv x rays. Irradiation was conducted in daily fractions of 500 r each, every other day, to give total doses of 2000 to 12,000 r. Even at low doses (500 to 2000 r) there was a reduction in the size of the nodes after 15 days, and the 2000-r dose diminished the number of cellular elements. At doses of 4000 to 12,000, an increase in cellular density was found at 15 days. At both examination periods, a decrease in nuclear volume and nuclear DNA content was seen, proportional in degree to the dose up to 4000 r; higher doses were relatively less effective in reducing nuclear size and DNA content. These changes were similar in lymphocytes and histiocytes. Thirty days after a relatively low dose (2000 r) the lymph nodes appeared normal morphologically, but nuclear size and DNA content were still slightly below normal. It was demonstrated that the reticular cells, which are considered to be radioresistant, underwent changes, detectable by karyometry and histophotometry, of the same kind seen in the radiosensitive lymphocytes. In the lymphocyte, these nuclear changes are apparently irreversible. (BBB)

25103 STUDIES ON THE INFLUENCE OF X RAYS ON PYRIDOXAL PHOSPHATE IN ESCHERICHIA COLI. H. Langendorff and H. Geyer (Universitat, Freiburg i. B.). Arch. Mikrobiol., 46: 1-8(1963). (In German)

In order to determine whether the death of living cells after x irradiation is connected with the destruction of pyridoxal phosphate (PLP) in the cell and blocking of pyridoxal-dependent enzymes, PLP was determined in irradiated and nonirradiated E. coli. Both dormant and growing cells were studied. PLP was determined spectrophotometrically by use of indole formation with L-tryptophane and apotryptophanase; a linear dependence was found. Below 10^{11} E. coli cells the yield of PLP is found to be directly proportional to the number of cells. Comparison of extraction with acid and with phosphate buffer was tabulated, and no destruction of PLP by heating 5 min at 100°C was noted. In dormant E. coli cells no significant change in PLP concentration was found up to 22 hr of incubation after irradiation with 40,000 r. Growing E. coli suspensions were irradiated with 10,000 and 80,000 r. In both controls and irradiated suspensions no PLP is produced in the lag phase, but production increases gradually in the log phase; growth is slightly retarded in the irradiated sample, and the PLP formation in irradiated samples falls below that in the control slightly after 100-min incubation. PLP per cell remains approximately the same. The lowest value of PLP/cell for normal conversion during growth was found to be 0.16×10^{-10} μg. This increases greatly at the end of the log phase in all cultures. (BBB)

25104 ON THE BEHAVIOR OF THE ADRENOSYMPATHETIC SYSTEM IN X-IRRADIATED SUBJECTS. V. Colamussi, B. Carrozzini, and A. De Bellis (Università, Ferrara, Italy). Arcispedale S. Anna Ferrara, 16: 317-39 (1963). (In Italian)

The urinary excretion of adrenal hormones in the urine was studied in 25 patients undergoing x-ray therapy in the region of the adrenal glands. Ten patients with arthritis in the lumbar region were treated with 1000 r, in 10 fractionated doses of 100 r each, of 180-kv x rays over a 10 × 15 cm field. The other patients, suffering from uterine or ovarian cancer, were given 20 to 30 150-r doses over a field of the same dimensions in the abdominal region. In the first group of patients, after doses of 300 to 1000 r had been accumulated, a progressive reduction of 24-hr levels of adrenaline and noradrenaline in urine was noted, but not invariably. In the second group, after the first doses of x rays there was an increased variation of the levels of these catechol amines in urine. In most cases in this group, noradrenaline levels were decreased after three to four doses but tended to increase after later doses; adrenaline rose after total doses of 900 to 1200 r and continued to rise after additional doses. In this second group of patients, the average catechol amine levels initially, after 900 to 1200 r, and after 4800 to 8400 r were: adrenaline 6.7, 7.2, and 8.7; noradrenaline 15.3, 14.2, and 17.9 μg/1000 ml. Because of large individual variations it could

not be unequivocally concluded that the adrenalsympathetic system is stimulated by irradiation, but it appeared that, in general, there is increased activity of this system after abdominal irradiation both at an early and a late stage of the treatment. (BBB)

25105 GENERAL ASPECTS OF THE PROBLEM OF THE BIOLOGICAL ACTION OF IONIZING RADIATIONS. Manoel Corte-Real (Instituto Portugues de Oncologia, Lisbon). Arquiv Patol., 34: 89-106(Dec. 1962). (In Portuguese) (cf. J. Med. (Porto), 49: 441-55(Nov. 3, 1962); NSA 17: 38805)

The mechanism of action of radiation on biological systems is discussed at the molecular level as well as on organ systems of higher animals. (BBB)

25106 RADIATION AND BIOLOGICAL MEMBRANES. I. S. Jenkinson (Atomic Energy Commission, Australia). At. Energy Australia, 7: No. 2, 10-13(Apr. 1964).

The early effects of ionizing radiation on cellular membranes was investigated. (C.E.S.)

25107 EXPERIMENTAL AND THEORETICAL STUDIES ON THE RELATIVE BIOLOGICAL EFFECTIVENESS OF NEUTRONS. IV. FUNDAMENTALS OF FAST-NEUTRON DOSIMETRY. E. H. Graul, H. Krueger, and H. Hundeshagen (Universitat, Marburg, Ger.). Atompraxis, 10: 185-90(Apr. 1964). (In German)

An analysis was made of the processes of physical interrelationship between neutrons and tissue, and the problems involved in determining the dose absorbed by the tissue. (P.C.H.)

25108 DOSE-EFFECT RELATION IN THE INDUCTION OF CROSSING-OVER WITH X RAYS IN MALES OF DROSOPHILA MELANOGASTER. Angela Olivieri and Gregorio Olivieri (Università, Rome). Atti Accad. Nazl. Lincei, Rend., Classe Sci. Fis., Mat. Nat., 34: 685-95(June 1963). (In Italian)

A study was made to determine the relation existing between the dose and the effect produced in the induction of cross overs in male Drosophila. Males of ages 0 to 24 hr, heterozygote in the 2nd chromosome for b cn vg bw, were exposed to x-ray doses of 500, 1000, 2500, and 4000 r. They were bred with b cn vg bw females, and the cross overs found in the descendants of the 7th to the 21st day after irradiation were determined. The results are tabulated, and their significance is discussed in detail. (J.S.R.)

25109 PATHOLOGIC CHANGES AND ELECTROCARDIOGRAPHIC CHANGES AFTER EXPERIMENTAL IRRADIATION OF THE HEART WITH Co-60. F. Barbaccia, A. La Selva, G. Luzzatti, L. Rossi, and R. Rovelli (Ospedale Maggiore, Milan). Atti. Soc. Ital. Cardiol., 22: 452-4 (1962). (In Italian)

Studies were conducted in rabbits exposed to 750- to 12,000-r epicardial doses of ^{60}Co γ rays and sacrificed 6 hr to 30 days later for histologic study of the heart. This was correlated with electrocardiographic studies. In a significant percentage of animals the electrocardiogram reflected signs of subendocardial injury: prolongation of the QT interval, a low, concave ST segment, and a flattening of the T wave. Somewhat later, about the 16th day, was noted an appreciable drop in voltage of the initial ventricular complex, attributable to a pericardial or myocardial reaction. Such changes were seen only after high doses (6000 and 12,000 r). Macroscopic examination of the heart showed a fibrinous pericarditis and in some cases focal myocardial fibrosis. Microscopically, after high doses, degenerative changes were seen in myocardial muscle fibers, with varying degrees of necrosis. This was accompanied by infiltration of inflammatory cells. These changes were most pronounced at early periods after irradiation; later, mesenchymal cells had effected repair, resulting in myocardial sclerosis. The myocardial blood vessels, in particular, were altered, with reduction in the diameter of their lumens by subintimal proliferation. These results show that the myocardium is not radioresistant, a fact that should be taken into consideration in applying thoracic radiotherapy to humans. (BBB)

25110 ON MODIFICATIONS OF AGGLUTINATING ACTIVITY OF TISSUE EXTRACTS IN VARIOUS EXPERIMENTAL CONDITIONS. II. CHANGES IN BASIC POLYPEPTIDES OF THE LIVER IN ANIMALS SUBJECTED TO IRRADIATION OF THE LIVER. P. De Rinaldis and R. Pantaleo (Università, Bari, Italy). Boll. Ist. Sieroterap. Milan., 42: 61-4(1963). (In Italian)

The effect of local irradiation of the liver on the ability of basic peptides extracted from it (by the method of Henon, et al., Rev. Immunol., 23: 245(1959)) to agglutinate Staphylococcus aureus (Oxford strain) was investigated in rabbits. The liver was irradiated with daily 1000-r doses of 180-kv x rays until the animal died, death usually occurring between the fourth and eighth days after accumulated doses of 7000 to 12,000 r. A marked decline in agglutinating activity of the peptides was noted on the fourth day postirradiation, whereas on the second and third day, after accumulated doses of 2000 and 3000 r, only a slight or no loss in agglutinability occurred. The activity measured on the seventh and eighth days was usually greater than on the fourth day, but normal values were not obtained. Similar results were found with a wide range of dilutions of the peptides (0.125 to 2.0 mg/ml). A similar depression of agglutinating activity of liver peptides was seen in rabbits fed carbon tetrachloride or chloroform. Possible alterations of the physical or chemical properties of these peptides by irradiation and hepatotoxic agents are discussed. (BBB)

25111 STUDIES ON THE PEROXIDASE ACTIVITY OF CHEMO-ANTIBIOTIC-RESISTANT MYCOBACTERIA SUBJECTED TO X IRRADIATION. F. A. Paolini and F. Moncalvo (Universita, Pavia, Italy). Boll. Soc. Ital. Biol. Sper., 39: 257-9(Mar. 15, 1963). (In Italian)

The effect of irradiation on peroxidase activity was investigated in eight human strains of Mycobacterium tuberculosis that had become resistant to various antibiotics by progressively larger concentrations being added to the culture medium. Individual strains were resistant to differing concentrations of kanamycin, streptomycin, isoniazid, and p-aminosalicylate, or to various combinations of these antibiotics. The bacteria were irradiated with 1000- to 80,000-r doses of x rays, then centrifuged and washed, and their peroxidase activity measured by a method that depends on the ability of peroxidase to oxidize, in the presence of H_2O_2, pyrogallol to purpurogallin. As was shown earlier with catalase activity in these resistant strains, irradiation did affect peroxidase activity of all strains tested. The activity was increased two to three times by the highest dose (80,000 r), and the increase was generally proportional to the dose. As was observed with catalase, there was no correlation between the degree of antibiotic resistance and enzyme activity, and irradiation did not affect this relation. (BBB)

25112 INVESTIGATION OF THE ACTION OF A RADIOACTIVE ISOTOPE (P^{32}) ON THE SURVIVAL OF SKIN HOMOGRAFTS IN THE RAT. E. Ruggieri, E. D'Alessio, P. De Franciscis, M. Coppola, C. Aufiero,

S. Cifaldi, and L. Negro (Università, Naples). Boll. Soc. Ital. Biol. Sper., 39: 1353-6(Nov. 30, 1963). (In Italian)

The effect of β radiation, applied in various ways, was studied in 500 rats of the Morini strain. In the first experiment, single doses (500 μC/kg body wt) of ^{32}P were injected intraperitoneally in both the donor and recipient rats 5, 10, 15, 20, 25, or 30 days before grafting. In this series, the best result was obtained when the injections were made on the 15th day; in this case the maximum survival time of homologous skin grafts was 35 days, compared with a control time of ~10 days. In the second experiment, a similar injection was made in the recipient rat only, at the same time intervals. Maximum survival time of the graft was increased to ~30 days when the injection was made 10 days prior to the transplantation of skin. When the injection was made in the donor only, survival time was increased to 28 and 35 days by injections of ^{32}P made on the 15th and 20th day, respectively. In the 4th series, the skin graft was incubated in a solution containing 1000 μC ^{32}P for 24 to 96 hr before it was transplanted. Incubation for 96 hr was most effective, the graft surviving for 33 days or ~3 times longer than untreated skin. In the last experiment, twice this amount of ^{32}P (2000 μC) was incubated with skin for periods up to 7 days. The best result, a survival time of 37 days, was obtained following 24-hr incubation. (BBB)

25113 ACTION OF ULTRAVIOLET RAYS ON THE SURVIVAL OF HOMOLOGOUS SKIN GRAFTS. E. Ruggieri, E. D'Alessio, P. De Franciscis, M. Coppola, C. Aufiero, L. Negro, and S. Cifaldi (Università, Naples). Boll. Soc. Ital. Biol. Sper., 39: 1356-7(Nov. 30, 1963). (In Italian)

Fresh excised skin from Wistar rats was irradiated with a mercury vapor lamp to compare the effects of ultraviolet with ionizing radiation on the rejection time of the subsequently grafted skin. As found with x irradiation, ultraviolet irradiation prolonged the survival time of the grafts; a maximum survival time of 34 days was obtained after two 15-min exposures were used. This is about the same enhancement of survival provided by x irradiation and thrice the time for unirradiated skin. (BBB)

25114 ACTION OF X RAYS ON HOMOLOGOUS SKIN GRAFTS. E. Ruggieri, E. D'Alessio, P. De Franciscis, S. Cifaldi, C. Aufiero, L. Negro, and M. Coppola (Università, Naples). Boll. Soc. Ital. Biol. Sper., 39: 1358-60 (Nov. 30, 1963). (In Italian)

Attempts were made to alter the antigenic reactivity of skin homografts in rats by direct irradiation of excised pieces of skin, either fresh or lyophilized, before transplanting it in the skin of recipients. Lyophilization was carried out at −22°C for 4 hr, and after irradiation the skin was rehydrated by immersion in physiologic saline for 30 min. Irradiation was conducted with 120-kv x rays to give doses of 300, 600, 900, 1200, or 1500 r. In the first series of tests, a maximum survival time of irradiated fresh skin of Wistar rats of 33 days was obtained after 600-r doses, compared with about 10 days for unirradiated fresh skin. Maximum survival time of lyophilized skin was also obtained with the 600-r dose; the time (35 days) was twice that of unirradiated lyophilized skin (15 days). The last experiment was repeated and the recipients were given an injection of spleen homogenate. Maximum prolongation of rejection time was 36 days, 600-r doses being most effective in this experiment as in the other two. (BBB)

25115 EFFECTS OF FASTING AND OF IRRADIATION ON THE POLYSACCHARIDE PHOSPHORYLASE ACTIVITY IN THE LIVER OF RATS. D. Bonsignore (Università, Genoa), C. Canonica, O. Sartori, and L. Lenzerini. Boll. Soc. Ital. Biol. Sper., 39: 1664-7(Dec. 31, 1963). (In Italian)

Whole-body irradiation of rats at a dose of 700 r resulted in an increase in liver glycogen formation on successive days. This was accompanied by an increase in liver activity of phosphorylase that was particularly evident at 12 and 24 hr postirradiation. This enzyme controls the formation and degradation of glycogen via glucose-1-phosphate. The effect of fasting on this phenomenon was investigated. Fasting of control rats for 12, 24, 48, and 72 hr caused the enzyme activity to increase 117, 108, and 33% and to decrease 8% at these respective intervals. In rats that were irradiated with 700 r and then fasted for the same periods, the respective changes were +42, +58, +33, and −17%. This shows that whole-body irradiation depresses the fasting-induced increase of liver phosphorylase activity for the first day of fasting and enhances the decrease of activity on the third fasting day. On the second day, irradiation did not affect the enzyme activity. The importance of controlling the food intake of irradiated animals in tissue enzyme studies is discussed. (BBB)

25116 EFFECT OF BLEEDING ON THE WHOLE-BODY IRRADIATED ANIMAL. A. Gubbiotti and F. Gallina (Università, Perugia, Italy). Boll. Soc. Ital. Biol. Sper., 39: 1693-5(Dec. 31, 1963). (In Italian)

Attempts were made to confirm a previous study showing that successive bleedings favored the survival of irradiated animals and improved their hematologic response. To this end 180 mice, divided into 7 groups, were irradiated at various intervals before or after bleeding. They were exposed to a single 700-r dose of x rays given at a rate of 70 r/min, corresponding to the $LD_{100/15}$ for these animals. The mice were bled to allow a blood loss of about one-half of the total blood volume. Whereas in the irradiated control mice the animals began dying on the 10th day and all were dead by the 15th day, in the groups bled before or after irradiation, deaths began at the 6th or 7th postirradiation day but some mice survived until the 18th day. This survival beyond the 15th day was noted in the groups bled 30 min after irradiation or immediately before irradiation but not in the three groups bled 24, 48, or 96 hr after exposure to x rays. In the latter three groups, all mice were dead by day 15 and deaths began earlier than in irradiated controls. In the two groups bled soon after or before irradiation, about 15% of the mice survived beyond the 15th day, compared with 0% in the controls. This difference was not considered to be significant. (BBB)

25117 BIOCHEMICAL AND MORPHOLOGICAL STUDIES OF RADIATION INJURY IN TISSUE CULTURE: A COMPARISON WITH CELLULAR INJURY IN ANTIGEN-ANTIBODY REACTIONS. H. Hayashi, A. Tokuda, T. Ono, and Y. Takaba (Kumamoto Univ., Japan). Brit. J. Exptl. Pathol., 44: 1-10(Feb. 1963).

Observations are reported concerning tissue injury caused by x irradiation. Cells obtained from the peritoneal fluid of rabbits were cultured in special chambers and exposed to x rays (1.2 min at a dose rate of 883 r/min of 40-kv x rays). The protease activity of the cells was then tested by a fibrin clot method. It is concluded that irradiation of cells causes release of a nonsulfhydryl protease with an optimal pH in the neutral range. Protease activation occurs almost simultaneously with morphologic changes in cytoplasm and mitochondria. At an earlier stage, a sulfhydryl protease is also released but this enzyme is in the

inactive state. There are morphologic and biochemical differences between the responses of cells to injury by irradiation and to antigen-antibody reaction. (BBB)

25118 JAUNDICE AFTER HALOTHANE AND RADIOTHERAPY. J. S. W. Chambers, P. F. J. Sewell, and H. B. Young (Doncaster Royal Infirmary, Eng.). Brit. Med. J., 1: 562(Feb. 29, 1964).

It is suggested that the combination of Ra treatment and halothane anesthesia is more likely to cause liver damage than the administration of halothane alone. A case history is reported in which the combination of repeated halothane administration, Ra implantation, and hysterectomy were associated with the development of fatal massive necrosis of the liver. The patient, aged 40 yr, was suffering from a carcinoma of the cervix, stage IIa. Radium was inserted, 1.5% halothane being administered for ~30 min. Five days later, a hysterectomy was performed under spinal anesthesia with 0.5% halothane given throughout the procedure. On the following day she developed nonobstructive jaundice and deteriorated very rapidly with increasing jaundice, and died in hepatic coma. The only abnormality found postmortem was a small liver weighing 1280 g, with loss of normal structure. Histologic examination showed massive necrosis without any cellular proliferative or lymphocytic or histiocytic reaction. This case seems strikingly similar to an earlier one reported in which jaundice appeared the day after operation and radiotherapy and was associated with massive necrosis of the liver. (BBB)

25119 JAUNDICE AFTER HALOTHANE AND RADIOTHERAPY. J. W. Ashton, K. J. O'Connor, and G. L. Williams (Chelsea Hospital for Women, London). Brit. Med. J., 2: 811(Sept. 28, 1963).

Three cases are reported in which acute liver injury developed after use of halothane as an anesthetic during the intracavitary implantation of Ra for treatment of uterine carcinoma. The first patient received x-ray treatments over the pelvic region prior to three Ra insertions; the second had three insertions of Ra without external irradiation; and the third was treated with Ra on two occasions, each time after halothane anesthesia. Jaundice, with signs of nonobstructive liver failure, occurred in each patient several weeks after the last treatment. The common factors in these three nonfatal cases were as follows: they were all cases of carcinoma in the pelvis; all received repeated anesthesia with halothane; and all were treated with Ra. In all the cases the liver edge was palpable in the acute phase. The first and second patients recovered with symptomatic treatment only, while the third responded dramatically to treatment with corticosteroids. In view of these findings it is suggested that the combination of Ra and halothane is more likely to cause liver damage than the administration of halothane alone. (BBB)

25120 STUDY OF THE DISTRIBUTION OF RADIOACTIVE IODINE IN OVARIES. P. Dor (Institut Jules Bordet, Brussels). Bull. Assoc. Franc. Etude Cancer, 50: 235-42(Apr.-June 1963). (In French)

Studies were conducted in 30 euthyroid women, aged 30 to 65 yr, who were undergoing ovariectomy as an adjunct to treatment for cancer; 20 had metastatic breast cancer and 8 uterine cervical carcinoma. Radioiodine (presumably ^{131}I) was administered orally 14 to 20 hr before ovariectomy in doses of 1 μC, except in three cases (300, 500, 500 μC), and radioactivity of plasma was followed at 1.5 and 6 hr later and at time of removal of the ovary. Distribution of radioiodine in the ovary was determined by autoradiography. The results are discussed with respect to three groups of patients: premenopausal, menopausal because of radiotherapy, and menopausal by reason of age. In the first group the activity of one liter of plasma at the time of ovariectomy averaged 0.75% of the administered dose and the specific activity of ovary was 52.6% of the specific activity of plasma. In the second group these respective values were 0.87% and 63.5%, and in the third group, 0.95% and 82.3%. These values as well as the results of autoradiography showed that ovarian tissue in these patients did not retain radioiodine; the radioactivity in the tissue was practically at background levels. Thus the Graffian follicles in the premenopausal women did not selectively incorporate radioiodine; in fact, more radioactivity was taken up by ovaries of menopausal than premenopausal women. It is concluded that radioiodine is not a particularly hazardous substance from the standpoint of the risk of ovarian irradiation. (BBB)

25121 CHARACTERISTICS OF HIGHER NERVOUS ACTIVITY IN ANIMALS PRENATALLY EXPOSED TO IONIZING RADIATION. I. A. Piontkovskii and R. I. Kruglikov (Inst. of Higher Nervous Activity and Neurophysiology, Academy of Sciences, USSR). Byul. Eksperim. Biol. i Med., No. 7, 35-8(July 1963).

Fifteen days after mating, gravid rabbits were exposed to single x irradiation (400 r). The offspring of the irradiated and control animals were kept under observation from the 3rd day after birth. The behavior of the experimental animals was marked by slower formation and slower stabilization of conditioned positive reflexes and by the failure to establish a differential response to acoustic stimuli. The irradiated animals had hematological and weight indexes similar to those in the controls. Morphological study of the brain of one-yr-old animals revealed a shrinkage in the brain mass, marked atrophy of the cortex, and absence or underdevelopment of the corpus callosum and cerebellum. Baby rabbits and some older animals made rotational movements or swayed rhythmically from side to side. Some animals gradually developed spastic paralysis of the hind paws. Irradiation on the 15th day apparently injured various elements in the single functional system responsible for inhibition. Tests revealed that the subcortical formations suffered greater impairment than did the higher cortical layers. (OTS)

25122 EFFECT OF IONIZING RADIATION ON LIVER REGENERATION IN WHITE MICE AFTER BRIEF AND PROLONGED EXPOSURE. G. S. Strelin and I. V. Shiffer (Central Scientific Research Inst. of Medical Radiology, USSR). Byul. Eksperim. Biol. i Med., No. 7, 87-91(July 1963).

The response of mammalian liver to different doses of irradiation was compared in connection with the level of physiological regeneration of the organ. The extent of liver injury was studied in adult white mice after brief (dose rate–20 r/min) and prolonged (dose rate–0.0232 r/min) irradiation with 1000 r of gamma rays (^{60}Co). Regeneration was found to be inhibited after a single exposure, but not after prolonged irradiation. The effect of the radiation decreased with reduction in the dose rate. The suggestion that after prolonged irradiation, radiation sickness is not pronounced and thus cannot affect the course of regeneration is supported by data indicating that local irradiation inhibits liver regeneration only when massive doses are used. (TCO)

25123 KINETIC STUDIES WITH ELECTRON PARAMAGNETIC RESONANCE ABSORPTION. ON THE DISAPPEARANCE OF RADICALS TRAPPED IN GAMMA-

IRRADIATED FLOUR. C. C. Lee and I. S. Bhardwaj (Univ. of Saskatchewan, Saskatoon, Can.). Cereal Chem., 41: 87-97(Mar. 1964).

The electron paramagnetic resonance (EPR) absorption spectrum was utilizdd to detect the presence of free radicals trapped in flour after irradiation with ^{60}Co γ rays and the kinetics of their disappearance. In addition, mixograms, farinograms, and baking data obtained from a flour before and after irradiation are compared. Three grades of flour, either oven-dried or at 3.0% moisture, were irradiated with 10^6 rad. Disappearance of the radicals was shown to follow second-order kinetics. The EPR spectra confirmed in a quantitative way the earlier qualitative finding that moisture enhances the rate of disappearance of the EPR-detectable radicals in γ-irradiated flour. The second-order specific rate constant for the disappearance of trapped radicals in a flour with 3.0% moisture was about 3 times as great as the constant for the corresponding oven-dried flour. The influence of 0.5- and 1.0-million-rad doses on the farinogram and mixogram also corroborated earlier observations on the deleterious effects of such dosages of radiation on the baking quality of flours. The finding that the disappearance of trapped radicals followed second-order kinetics for both oven-dried flour and flour with 3.0% moisture suggests radical recombination according to the equation: $R\cdot + R\cdot \rightarrow R-R$. However, this appears to be unlikely in the case of flour containing 3.0% moisture. The densities of the tightly packed flours used for the EPR measurements were about 0.7 g/ml. With a water content of 3.0%, the water concentration in such flours would be about 10^{-3} moles/ml. Most of the radical concentrations were within the range of 10^{17} to 10^{18} spins/ml, which is of the order of 10^{-5} moles/ml. While drying as well as irradiation caused marked differences in dough-mixing characteristics, the changes in baking performance with time resulted in only very minor effects on the mixograms. The present results, however, suggest that when flour is irradiated at its usual moisture level of about 12 to 14%, the predominant fate of any free radical fragments resulting from the irradiation will not be polymerization, but more likely will be reaction with water via processes such as the above equations. The net effect of such reactions will be breakdown of flour constituents, which would be responsible for deterioration in baking quality. (BBB)

25124 EARLY INHIBITION OF THE OYYGEN CONSUMPTION OF THE CHICKEN EMBRYONIC INTESTINE IN ORGANOTYPIC CULTURE, PROVOKED BY IRRADIATION WITH X RAYS. George Le Douarin and Jean-Michel Kirrmann (College De France, Paris and Centre National de la Recherche Scientifique, Paris). Compt. Rend., 258: 2917-20(Mar. 9, 1964). (In French)

A single irradiation with a 7500-r x-radiation dose decreased by approximately 20% the oxygen consumption of the embryonic intestine in culture. This effect was observed just one hr after the irradiation. (fr-auth)

25125 SOME EFFECTS OF GAMMA RADIATIONS ON THE FARINA MOTH AND ON NEMATODES. J. Van Den Brande and C. Pelerents. Compt. Rend. Rech. (Inst. Encour. Rech. Sci. Ind. Agr.), No. 28, Vol. I, 11-47(Nov. 1962). (In French)

The effects of gamma radiation on the farina moth (Ephestia kuehniella) and on some nematodes were studied. The biology and breeding of the moth are described as an introduction to the examination of the test results on eggs, larvae, and chrysalis. The irradiation of the eggs up to doses of 9000 rad showed that radioresistance to γ rays increased with the age of the embryo. The mutations obtained were hereditary. For no dose was the number of butterflies obtained comparable to the number of the controls and a sterility of 100%. The irradiation of larvae showed the existence of a sex-dose interaction for doses of 4000, 5000, and 7000 rad. Doses higher than 6000 rad decrease the number of butterflies, but doses of 3000, 4000, and 5000 rad increase significantly the number of butterflies. The irradiation of chrysalis showed that the induction of sterility is a function of the chrysalis age. The mutation is of the dominant type and is induced very easily. Free nematodes, nematodes of knotty roots, and cysted nematodes were exposed to doses up to 1,280,000 rad. The results are discussed and show that a dose of at least 80,000 rad is necessary to obtain an effect comparable to that of nematicides. (J.S.R.)

25126 THE APPLICATION OF IONIZING RADIATIONS AS MUTAGENIC AGENTS IN THE IMPROVEMENT OF GREEN FODDER CROPS. H. Reyntens and R. De Loose. Compt. Rend. Rech. (Inst. Encour. Rech. Sci. Ind. Agr.), No. 28, Vol. I, 53-75(Nov. 1962). (In Dutch)

The factors affecting the radiosensitivity of plants were investigated in winter rye seeds. The factors studied were moisture content, temperature treatment before irradiation, wave length of the radiation, and ascorbic acid content. The results are shown in tabular form and discussed. (J.S.R.)

25127 THE EFFECT OF REPEATED SUBLETHAL IRRADIATIONS ON RADIORESISTANCE AND RADIOEXCITABILITY. H. Maisin (Université, Louvain, Belg.). Compt. Rend. Soc. Biol., 157: 1822-5(1963). (In French)

In the adult rat, doses of 1 and 0.1 r repeated 3 to 7 times at intervals of from 15 to 42 days do not produce radioresistance with respect to a 50% lethal dose. No medullary radioexcitability could be detected. (tr-auth)

25128 EFFECT OF X RAYS ON THE METACERCARIA OF FASCIOLA HEPATICA. E. Lagrange. Compt. Rend. Soc. Biol., 157: 1826(1963). (In French)

The lethal effect of x rays on metacercaria of Fasciola hepatica was studied at doses from 500 to 5000 r. After exposure the metacercaria were injected subcutaneously and given orally to mice. The survival of the mice showed that doses of 5000 r killed the metacercarias, but the mice received no vaccination effect. These mice, receiving 2 months later metacercaria exposed to 2000 r, all died within the normal period after injection. (J.S.R.)

25129 MUTATIONS IN COTTON INDUCED BY GAMMA-IRRADIATION OF POLLEN. J. B. Pate and E. N. Duncan (Tennessee Agricultural Experiment Station, Knoxville, Tenn.). Crop Sci., 3: 136-8(Mar.-Apr. 1963).

Gamma irradiation of pollen at 400, 800, 1600, and 3200 r was investigated as a method of inducing potentially valuable mutants in cotton. Stimulative or heterotic effects from irradiation were indicated in that boll set and seed production were greater in the M_0 400 r treatment than in the control. Higher emergence and seedling survival from 400- and 800-r treatments in the M_1 generation indicated a similar effect. Plant height was reduced approximately one-third in a short internode mutant derived from the 400 r treatment. It may be of value as a breeding stock to reduce plant size. Marcel leaf, stipple leaf, and female sterile mutants were isolated from the 800-r treatment. Marcel leaf is associated with very high T_1 fiber strength and could be of value as a breeding stock. Stipple leaf and female sterile are easily classified and could be useful as genetic markers. Three leathery leaf conditions, one from

the 400-r treatment and two from the 800-r treatment, are similar phenotypically. Preliminary data on their behavior indicate that chromosomal aberrations may be involved. These investigations indicate good probabilities of obtaining qualitative mutants following gamma irradiation of cotton pollen at 400 and 800 r. Changes in quantitative characters of economic importance may have been induced in these studies, and this possibility is being investigated. (auth)

25130 IRRADIATION-INDUCED MUTATIONS IN A COLCHICINE-REACTIVE GENOTYPE IN SORGHUM. H. D. Haensel, J. G. Ross, and C. C. Huang (South Dakota Agricultural Experimental Station, Brookings). Crop Sci., 3: 242-5(May-June 1963).

Gamma irradiation of sorghum panicles of a colchicine-reactive genotype just prior to anthesis resulted mostly in single-gene mutations and sterility. A large proportion of the latter may be due to chromosome breakage. No vast phenotypic changes similar to those observed after colchicine treatment of this genotype were observed. The following differences between irradiation and colchicine treatment as a mutagenic agent in this genotype were noted: irradiation gave heterozygous mutants, while most colchicine-induced mutants reported have been immediately homozygous; irradiation appeared to mutate single genes, while many genes have been found mutated within a single plant after application of colchicine; the frequency of mutation after irradiation was much lower than that demonstrated after colchicine treatment; irradiation caused sterility, some of which may be due to chromosome breakage, while colchicine did not cause sterility (except cytoplasmic male sterility) or chromosome breaks; irradiation gave many inviable mutants while colchicine mutants were, in general, as vigorous or more so than the original. The mutagenic effects of irradiation applied at the pre-anthesis stage in the colchicine-reactive genotype, appeared to be different from those previously obtained by treating with colchicine at the seedling stage. (auth)

25131 DOSAGE EVALUATIONS FOR GAMMA IRRADIATION OF RHODESIAN SUDANGRASS SORGHUM ARUNDINACEUM SEED. J. P. Craigmiles and H. B. Harris (Georgia Experiment Station, Experiment, Ga.). Crop Sci., 3: 452(Sept.-Oct. 1963).

The critical dose of γ radiation for Rhodesian sudangrass (Sorghum arundinaceum) was determined to be approximately 30 kr under the experimental conditions used. Dormant seeds from selfed plants were exposed to radiation doses ranging from 10 to 60 hr. Seedling emergence and seedling height were significantly reduced by 40- and 60-kr doses. Although there appeared to be a visible increase in vigor in the plants of the populations treated with low doses of γ radiation, a statistically significant increase in either emergence or height was not evident. (C.H.)

25132 BREEDING VALUE OF THE X-RAY INDUCED MACRO-MUTANT. I. VARIATIONS AMONG NORMAL APPEARING F_2 FAMILIES SEGREGATED FROM CROSSES BETWEEN MACRO-MUTANTS OF PEANUTS (ARACHIS HYPOGAEA L.). D. A. Emery, W. C. Gregory, and P. J. Loesch, Jr. (North Carolina Agricultural Experiment Station, Raleigh). Crop Sci., 4: 87-90(Jan.-Feb. 1964).

Morphological mutant expression in peanuts is commonly associated with one to a few gene mutations. To make critical evaluations of the background or polygene mutations associated incidently with deleterious gene changes, the backgrounds in question were separated from their respective morphological markers by hybridizing five deleterious x-ray-induced mutants in all possible combinations to allow recombination of all gene mutations. F_2 families displaying the recessive markers were then removed from the hybrid populations and the effects of background or quantitative gene changes were measured among the mutated but normal appearing F_2 families in the F_4 generation. Evidence supporting deleterious mutant background mutation is presented. Observations of means and variances of four quantitative characters used to differentiate F_2 families tracing to specific mutant pairings indicated a wide range of expression across backgrounds. Genetic variances around the means and selection responses among the hybrid families within background-blocks were in general greater than those associated with control families. Selection for increased yield among F_2 families in the F_5 generation was usually effective in those backgrounds where significant genetic variances were noted in the F_4 generation. Characters such as leaflet length and kernel size appear to be closely associated with the genetic systems controlling fruit length. The validity and application of the multimutation hypothesis is described. (auth)

25133 X-RAY INDUCED TALL MUTANT OF BLACK GRAM (PHASEOLUS MUNGO L.). Manas K. Jana (Indian Inst. of Tech., Kharagpur). Current Sci. (India), 32: 469-70(Oct. 1963).

Dry seeds of Phaseolus mungo were exposed to 40,000 r x radiation. One plant from the X_1 generation was marked for weak growth and color changes in the leaves. Seeds from this plant produced five normal and three conspicuously different plants. Seeds of the five normal plants were sown and the F_2 families segregated in three normal to one mutant ratio. (C.H.)

25134 INVESTIGATIONS ON THE QUESTION OF IMMEDIATE DETECTION OF BIOLOGICAL EFFECTS OF X RAYS. R. Schuppli and H.-H. Wagener. (Dermatologische Universitätsklinik, Basel). Dermatologica, 128: 27-34(1964). (In German)

A comparison of the frequency conductivity method and Lambert's injection pressure method (modified also by measurement of the amount of fluid flowing into the tissue) for determining effects of x rays was made. Frequency conductivity studies were made on a 5 × 5 cm muscle preparation (gluteus maximus) on a narcotized (Nembutal. intravenous) rabbit. The curve for 170 cycles/sec on irradiation with 5000 r at 100 kv shows a decrease from 0.74 to 0.71 ma, much less than observed in skin reactions. With 50-kv x rays, no reaction was observed. The injection pressure was determined by Lambert's method on the same muscle (injection needle 5 mm deep); irradiation with 4800 r at 50 kv caused a drop from ca. 50 cm H_2O to ca. 20 cm. The new modification was studied in comparison to hyaluronidase effects, using the pig. Infusion pressure was 60 cm H_2O, fluid 0.9% NaCl/H_2O, irradiation was 10,000 r. The number of drops/10 sec rose from 0.9 on irradiation to 3.0; after 6 min this fell to 1.5. A second irradiation partially overlapping the area irradiated the first time then caused a slower rise to 3.0 again. Subcutaneous administration of hyaluronidase caused an increase in drop/10 sec from 1.5 to 5.4. This value did not change appreciably for 3 hr. Thus frequency conductivity results are different for muscle and skin, while the Lambert injection pressure method gives identical results in the two systems. The different mechanism of x-ray spreading and hyaluronidase spreading is demonstrated by the new technique described above. (BBB)

25135 THE EFFECT OF X-RAYS ON SECONDARY FORMATION OF GILLS IN BRANCHIURA SOWERBYI. Norimoto Tanaka and Yoshio Nakao (Kyoto Prefectural Univ. of Medicine). Dobutsugaku Zasshi, 72: 289-92(Oct. 1963). (In Japanese)

The effect of x rays on the secondary formation of gills and regeneration in Branchiura sowerbyi was studied. Secondary gill formation was found to be very resistant to x irradiation. It takes place even under a radiation dose of 150 kr. Regeneration is relatively more sensitive than secondary gill formation, its upper limiting dose lying between 2.5 kr and 10 kr. The animal irradiated by a stronger x-ray dose (10 kr or more) fails completely to regenerate. It has been shown by Nakamura (1941) that the secondary gill formation process and the regeneration process are independent of each other. This experiment supports his findings. Many morphologically abnormal gills were formed under x-ray doses greater than 10 kr. (Nucl. Sci. Abstracts of Japan, 3: (Apr. 1964))

25136 THE DIMENSIONS OF LEAF TISSUE NUCLEI AFTER IRRADIATION. P. A. Vlasyuk and V. V. Sil'chenko (Ukrainian Research Inst. of Plant Physiology, Academy of Sciences, Ukrainian SSR). Dokl. Akad. Nauk SSSR, 155: 668-9(Mar. 21, 1964). (In Russian)

Air-dried seed of the sugar beet were irradiated with 500 to 25,000 r of ^{60}Co γ rays. The plants were grown, and measurements of the cell dimensions were carried out on nuclei of the assimilatory tissues during interkinesis. No difference in the dimensions of the nucleus could be observed between the controls and plants irradiated with a relatively small dose of 500, 1000, 2500, and 5000 r. On irradiating the seed with 25,000 r, a break-down in plant structure was observed with an increase in the dimensions of the nucleus. An increase of 22.2% in the diameter of the nucleus was observed in the 10th row of leaf cells as compared to the unirradiated controls, while the increase was only 14.8% in the 20th row of leaf cells. (TTT)

25137 THE MECHANISM FOR THE DECREASE IN DNA LEVEL OF TISSUE AFTER IRRADIATION OF AN ORGANISM. I. Ivanov, O. N. Borovikova, V. G. Vladimirov, V. B. Dolgo-Saburov, and V. I. Sharobaiko (Kirov Military Medical Academy). Dokl. Akad. Nauk SSSR, 155: 683-4 (Mar. 21, 1964). (In Russian)

The lymphocytes from the spleen of 19 white rats were examined before and one day after the rats were given a whole-body dose of 300 r. Photometry of the lymphocytes was carried out on freshly-prepared, unfixed sections of the spleen that were treated with a 0.1% solution of acridine orange. The cells of unirradiated animals showed a green fluorescence in ultraviolet light, while damaged cells show a red fluorescence. Thus, it was possible to determine the functional state of the cell. The amount of DNA in the cell was estimated from the absorption of ultraviolet light at 265 and 280 mμ. It was found that the DNA content of lymphocytes from the unirradiated controls did not differ significantly from the DNA content of lymphocytes from irradiated animals which retained their ability to fluoresce green in the presence of acridine orange (6.49×10^{-12} and 6.23×10^{-12} g of DNA per cell respectively). On the other hand, the DNA content of lymphocytes with red fluorescence (a sign of cell injury) had decreased sharply (1.81×10^{-12} g of DNA per cell). The overall decrease of DNA in the spleen was 45% after irradiation. It can be concluded that the death of a cell is accompanied by depolymerization of DNA, but that the amount of DNA does not fall off in a viable cell, even if the cell is irradiated. (TTT)

25138 THE EFFECTS OF Co^{60} γ-RAYS ON FRIED BEAN CURD. IX. THE COMPARISON OF TRAPPING EFFICIENCIES OF VOLATILE COMPOUNDS BY "COLD-TRAPS" AND ACTIVATED CHARCOAL. Chieko Urakami and Toyoko Takemura (Osaka City Univ.). Eiyo To Shokuryo, 15: 200-3(Sept. 1962). (In Japanese)

The analyses of the oil extracted from the meat of fried soy bean curd according to Floch's method showed the absence of sulfur but the presence of phosphorus presumably indicating the presence of phosphatides. The oil was found to contain about 70% linoleic and 12 to 15% linoleic acids. Activated charcoal was found to be much more efficient in trapping both volatile acid and carbonyl compounds rather than cold traps in a dry ice-acetone bath. It appeared that the number of days elapsed after extraction of the oil affected the number of the carbonyl compounds detected on the paper chromatograms, i.e., 3 distinct spots could be detected at 4 days after extraction of the oil but the one with R_f 0.01 ~ 0.04 disappeared after 20 days and the one with R_f 0.84 disintegrated to give 4 different compounds. (auth)

25139 APPLICATION OF PROGRESSIVE EXTRACTION AND OF CHROMATOGRAPHY TO FLOURS IRRADIATED BY GAMMA RAYS. A. R. Deschreider (Affaires Économiques et de l'Energie, Laboratoire Centrale, Brussels). Fermentatio, [No. 3], 125-36(1963). (In French)

The effects of gamma radiation on the proteins, carotenoids, lipides, xanthophylls, and starch were investigated. Two flours were irradiated to doses of 0.2 and 5.0×10^6 rad and were fractionated by progressive extraction. The fractions were examined by spectrophotometry, capillary chromatography, and column chromatography. Specific results are presented and discussed. (D.C.W.)

25140 EFFECTS OF TOTAL-BODY IRRADIATION, II. ON THE BLOOD PROTEINS OF THE RAT (SINGLE IRRADIATION). P. Gonzalez Rincones and P. Kozma (Universidad Central de Venezuela, Caracas). Gac. Med. Caracas, 69: 83-93(Jan.-Mar. 1961). (In Spanish)

Changes in serum proteins were studied in the rat following whole-body x irradiation at different doses. The blood sera of 40 rats, average age 6 months, were examined by paper electrophoresis prior to and after irradiation. Doses were 100, 200, 400, and 700 r of 250-kv x rays. Results of serum protein determinations carried out for 31 days postirradiation showed that in animals receiving 100 to 200 r the albumin fraction decreased during the first week. There was no significant alteration in the other protein fractions. Following irradiation with 400 r there were changes in all fractions during a period of 31 days, after which initial values were regained. A 40% decrease in albumin within the first 24 hr was followed by a gradual return to normal by the 4th week. γ-Globulin, which was low on the first day postirradiation, rose above normal from the 3rd to the 12th day, returning to normal during the 4th week. Both α-globulin fractions rose markedly the first day, α_1-globulin remaining high and α_2-globulin below normal values. After a moderate rise, β-globulin decreased by the 4th week. (BBB)

25141 CYTOCHEMICAL FINDINGS IN THE LIVER AFTER EXPERIMENTAL IRRADIATION. F. Savarese, V. Magliulo, and U. Ruberti (Università, Genova, Italy). Giorn. Ital. Patol. Sci. Affini, 6: 485-507(Nov.-Dec. 1956). (In Italian)

25142 A MODEL FOR CALCULATION OF RADIATION DOSES TO THE GASTRO-INTESTINAL TRACT OF RUMINANTS. R. J. Garner (United Kingdom Atomic Energy Au-

thority, Harwell, Berks, Eng.). Health Phys., 10: 297-301 (May 1964).

For purposes of calculation of time-integrals of concentration of insoluble radionuclides in various parts of the ruminant gut a simplified version of the compartmental model originally proposed by Blaxter et al. was adopted as a basis. In the reticulo-rumen material is assumed to be immediately distributed uniformly throughout the contents and then lost exponentially to the hind gut. The hind gut is visualized as a tubular structure through which material flows continuously without mixing. Values are derived for the cow, sheep, and goat, for the half-time of retention in the reticulo-rumen, for concentration factors applicable to individual segments of the gut, and for the time to first appearance in various parts of the hind gut. Methods of calculating beta and gamma doses are then described. (auth)

25143 STUDIES ON THE RADIATION SENSITIVITY OF DROSOPHILA EMBRYOS. Ivar Johansen (Norsk Hydro's Inst. for Cancer Research, Montebello, Norway). Hereditas, 48: 543-4(1962).

Radiation sensitivity of the embryos was studied in relation to age of embryo, dose rate, and dose fractionation. The dose response curves for different ages showed differences both in LD_{50} level, and in the shape of the dose response curve. Extrapolated values were estimated by fitting theoretical curves to the experimental points. Dose-rate effects were studied in 60(±5)-min-old eggs. It was found that although the LD_{50} shows very little change, the estimated extrapolation number does change with dose rate. In experiments where the x-ray beam was interrupted by means of a rotating slotted steel disc, it was found that the oxygen enhancement ratio was unchanged when compared with continuous irradiation, indicating that the efficiencies of oxygen-dependent and oxygen-independent mechanisms of radiation damage are not changed when the radiation is delivered in pulses of 40-sec duration. (BBB)

25144 SYMPOSIUM ON ACUTE RADIATION INJURY: INTRODUCTION TO SYMPOSIUM. D. J. Stevens (Commonwealth X-ray and Radium Lab., Melbourne). J. Coll. Radiologists Australasia, 7: 206-8(Oct. 1963).

The early effects of radiation in humans is discussed, particularly with respect to the estimation of acute radiation doses received by persons exposed in criticality and other accidents. (BBB)

25145 PHYSICAL ASPECTS OF ACUTE WHOLE-BODY RADIATION EXPOSURE. E. W. Titterton (Australian National Univ., Canberra). J. Coll. Radiologists Australasia, 7: 209-14(Oct. 1963).

Ways in which a person could receive total doses of penetrating radiation of the order of hundreds of rem delivered in a short period of time are considered. The distribution of energy in a nuclear explosion is given, and the relative hazards from blast, heat, and various ionizing radiations are assessed. The nature of accidents that may occur with high-energy accelerators and other electronic equipment is discussed. One serious radiation accident with a high-power electronic tube employed in radiocommunication facilities is described. (BBB)

25146 PHYSICAL ASPECTS OF ACUTE RADIATION EXPOSURE OF SUPERFICIAL TISSUE. D. F. Robertson (Univ. of Queensland, Brisbane). J. Coll. Radiologists Australasia, 7: 214-16(Oct. 1963).

The types of skin and eye injuries that result from exposure to nuclear explosions or accidents, electron beams, and medical x and γ rays are discussed. The effect of ^{90}Sr β radiation on the eyes at various doses is discussed. (BBB)

25147 THOROTRAST-INDUCED CHOLANGIOMA WITH HYPERCALCEMIA AS A PROMINENT FEATURE. F. Bekheit, Z. Nooman, S. Wassef, and M. Saif (Inst. of Research for Tropical Medicine, Cairo). J. Egypt. Med. Assoc., 46: 63-77(1963).

The case history is described of a 50-yr-old man who developed a pain in the right abdomen and who, upon radiologic examination of this region, revealed opacities of unusual type in the liver area. His history indicated an injection of Thorotrast 26 yr earlier for hepatosplenography. The patient died after an exploratory laparotomy which revealed tumor-like masses in the liver. Post mortem examination showed these whitish masses, about 5 cm in diameter, to be composed of dense fibrous tissue. The spleen was shruken and fibrotic. Histologic study of the liver demonstrated dilatation of the biliary system and hyperplastic changes in the bile ducts. Fibrous strands in the liver parenchyma and the Kupffer cells showed accumulations of yellowish-black refractile crystals, presumably ThO_2. A well-differentiated adenocarcinoma was present which had probably arisen from intrahepatic bile canaliculi, i. e., a cholangioma. A nodule containing ThO_2 particles was also found in the adrenal gland. Surface counting with a highly shielded scintillometer showed highest activity over the liver tumor and less activity in the rest of the liver and the spleen. No activity could be detected in samples of stomach, kidney, gall bladder, or desiccated bile. X-ray-diffraction examination of ashed tissue showed the presence of calcium thorate and calcium thorophosphate in addition to thorium dioxide. Hypercalcemia was present in this case and was attributed to increased absorption of calcium via the gastrointestinal tract. The literature relating to Thorotrast-induced tumors and the nature of thorium-emitted radiation are discussed. (BBB)

25148 DEVELOPMENT OF THE EAR IN X-IRRADIATED PARABIONTS OF AMBLYSTOMA. Jean Piatt (Univ. of Pennsylvania, Philadelphia). J. Exptl. Zool., 155: 117-28(Feb. 1964).

Experiments were conducted to determine to what extent parabiosis reduces radiation damage of specific organs in Amblystoma punctatum. Embryos were x irradiated at stage 26 with doses of 200, 400, and 600 r. Some animals from each irradiation lot were set aside as unoperated controls for a study of ear development and a number were maintained until death for survival data. Eighteen hours after irradiation two sets of operations were performed: the right otic vesicle of an irradiated embryo was transplanted orthotopically to a nonirradiated embryo; and irradiated embryos were united in parabiosis with nonirradiated embryos. Some of the irradiated parabionts were donor animals of the first operation; other irradiated parabionts were unoperated animals. Single, irradiated animals, nonirradiated animals with irradiated right ear grafts, and the irradiated parabionts were sacrificed 22 and 32 days after irradiation and a study was made of the relative growth and differentiation of the irradiated ears. Parabionts which received 400 and 600 r developed very poorly and in most cases were partially absorbed by the normal parabiont. Thus the data on ear development is derived entirely from the 200 r group. Single animals irradiated with 200 r lived for about 3 weeks. The ears of single, irradiated animals developed poorly. The ear in almost all cases was a relatively small, single vesicle with little or no differentiation of parts. Irradiated ear grafts

that developed orthotopically in nonirradiated animals were relatively well differentiated. The pars basilaris was the only structure consistently absent. Reduction in overall size and incompleteness or irregularity of shape of the various parts were the chief deviations from normal ears of comparable age. Maximum protection of the irradiated embryonic ear was afforded by transplantation. Development of the ears in irradiated parabionts was inferior to that of the irradiated grafts and, only slightly superior to that of ears in single, irradiated individuals. Thirty-eight of the parabiotic ears were slightly superior to those of single, irradiated animals, 25 about equal in development, and slightly inferior. Within their respective series, the developmental ratings of left (parabiont) and right (graft) ears of the same irradiated individual were comparable, indicating that the respective range of ear development within each of the two series was caused by slight variations in the radiation dosage absorbed by different individuals. It is concluded that parabiosis affords little, if any, radiation protection to the developing ears of irradiated parabionts. (BBB)

25149 MALIGNANT AFFLICTIONS AND WEAK DOSES OF IONIZING RADIATIONS. M. Delpla. J. Radiol. Electrol. Med. Nucl., 44: 157-65(Dec. 1963). (In French)

The results of the principal investigations giving data on the induction of malignancies by low radiation doses are reviewed and compared. The verification of the linear relation proposed by Court-Brown and Doll for very low doses, corresponding to in utero radiodiagnosis or to extremely localized radiotherapy, does not withstand a critical examination of the literature. Moreover, the application of statistical methods to the comparison of selected samples in the human population is inadmissable. It is concluded that the carcinogenic effect attributed to radiation rises, in reality, from congenital differences. 23 references. (tr-auth)

25150 EXAMINATION OF EXPERIMENTAL LEUKOPENIA AND LEUKOCYTOSIS IN PARABIOTIC AND WHOLE-BODY IRRADIATED RABBITS. Gabriella Foris and Pal Kertai (State Inst. of Hygiene, Budapest). Kiserl. Orvostud., 15: 88-93(Feb. 1963). (In Hungarian)

Hematologic reactions caused by irradiation or injection of colloid solutions and suspensions were studied in parabiotic rabbits; 42 pairs of rabbits were united to form parabiotic pairs and experiments were carried out on the 7th day after operation. Whole-body, 400-r x irradiation was used where called for in the experiments. A biphasic leukopenia-leukocytosis reaction was brought about by intravenous injection of 5 ml/kg 5% starch solution or 3 ml/kg granulocyte suspension. When the number of leukocyte cells was counted 5, 15, 30, 60, 120, and 240 min after injection, very low counts were seen at 5 to 15 min followed by a sharp rise from 30 to 120 min. In control experiments, when one member of the rabbit pair received saline solution, usually the granulocyte count never fell below 2000/mm^3. When starch solution was injected into one member of a pair, this rabbit's granulocyte level decreased from 3200 to 300/mm^3 within 5 min then rose to normal in 30 min, and reached 15,000 in 2 hr. The untreated partner showed no leukopenia; in fact his granulocyte count increased steadily. In the second series of tests the rabbits received whole-body irradiation and the starch test was performed weekly for 6 weeks. Results showed that the granulocyte count dropped one week after irradiation; regeneration started the 3rd week and was completed by the 6th week. However, lymphocyte count did not completely recover by the 6th week after having decreased the 1st week. In the 3rd series of tests attempts were made to determine whether radiation damage to the bone marrow also blocks the synthesis of leukocytosis-stimulating substances. In parabiotic experiments, one member of the pair received whole-body irradiation, was united with another rabbit one week later, and experiments were carried out one week after the operation. When the irradiated partner received the starch injection, leukopenia developed, but not leukocytosis; however, the nonirradiated partner showed signs of slowly progressing leukocytosis. The initial granulocyte count of 4000 reached 7500/mm^3 after 240 min. When the opposite experiment was performed the following day (injection of the nonirradiated parabiont with starch), this resulted in leukopenia and leukocytosis in the uninjected partner, and leukocytosis in the x-irradiated partner. These results indicate that the leukocytosis-stimulating substance is released by the x-irradiated rabbit. It is suggested that these tests may be useful for observation of various bone marrow functions and for testing radioprotective substances. (BBB)

25151 EFFECTS OF DIAGNOSTIC IRRADIATION. F. D. Sowby. Lancet, 1: 718(Mar. 30, 1963).

A reply is offered to the suggestions that fear of leukemia induction from irradiation of the human fetus in utero is causing an increase of perinatal deaths. Thus Rabinowitch has suggested that more x-ray pelvimetry be done as a means of reducing infant mortality rates. He contends that since 1956 there has been an increase in the death-rate due to birth injury and postnatal asphyxia, and implies that the alleged increase is the result of the virtual cessation of x-ray examinations during pregnancy. A possible explanation which is offered, other than the one put forward by Rabinowitch, is that the increase in the number of deaths listed by him was merely an outcome of the larger number of births during the corresponding years. The death rates quoted by Rabinowitch are the total numbers of deaths in certain years. If these are expressed as deaths per 1000 live births, there is no evidence of a rise in the infant mortality rate from birth injury. If there is any trend, it is towards a decrease, although it should not be concluded that this was the result of the cessation of pelvic radiography. Rabinowitch refers to the lower infant mortality figures in Holland and Norway, as compared with the United Kingdom. But infant mortality rates in these countries are not lower because of more extensive pelvimetry there, because the recent report of the United Nations Scientific Committee on the Effects of Atomic Radiation indicates that pelvimetric examinations are rarely if ever performed in the Netherlands and are rarer in Norway than in the United Kingdom. It is concluded that the claim that a decrease in the amount of pelvimetry has resulted in an increased infant mortality from birth injury and postnatal asphyxia cannot be supported by the figures quoted by Rabinowitch. (BBB)

25152 EFFECTS OF DIAGNOSTIC IRRADIATION. J. Rabinowitch. Lancet, 1: 833(Apr. 13, 1963).

Evidence associating leukemia with prior diagnostic radiology exposure is examined and it is concluded that other causes outweigh radiation and that x-ray pelvimetry during late pregnancy should be conducted when necessary. (BBB)

25153 THE PRESENT STATUS OF THE DIAGNOSIS OF CHRONIC RADIATION SICKNESS. D. Kolesar (Komenskeho Univ., Bratislava). Lekar. Obzor, 12: 399-410 (1963). (In Czech)

The literature on the diagnosis of radiation sickness is reviewed and 63 references cited. The diagnosis of chronic

radiation sickness is based primarily on clinical examination but there is a wide range of auxiliary clinical and laboratory tests available to aid in the diagnosis. In cases of internal contamination the examination is complete only with radiochemical investigation of urine and feces. On the basis of these investigations it is possible to differentiate the stage of initial symptoms from signs of prolonged exposure. In an individual in whom exposure has been discontinued for a long period of time, residual effects of chronic irradiation may be found. The classification into the individual stages differentiated by the severity of clinical and laboratory findings in chronic radiation sickness is of great prognostic importance, medicolegal value, and also has therapeutic implications. For the diagnosis of occupational injury from ionizing radiation, the laboratory and clinical findings must be supplemented with objective data on the hygienic conditions in the worker's environment. (BBB)

25154 RADIOMIMETIC ACTION OF ANTITUMOR AGENTS OF THE CHLORETHYLAMINE GROUP ACCORDING TO ANALYSIS OF CERTAIN BIOCHEMICAL INDICATORS. A. I. Malakhovskii. Lietuvos TSR Mokslu Akad. Darbai, Ser. B, 3: 171-6(1962).

It was found that after peroral administration to rats of lonine-3 (2 mg/kg), (I), and of preparation K-84 (30 mg/kg), (II), for 15 days, as well as after irradiation with 800 r and two subcutaneous injections of ^{32}P seven days apart, the activity of a number of enzymes changes. Carboanhydrase activity in the blood decreases by about half after irradiation (external and internal); under the effect of (I) and (II) the activity drops by 20 to 34%. In both instances carboanhydrase activity in the liver does not diminish as much. Blood asparticoaminoferase activity increases by about one-sixth with irradiation; (I) and (II) also elicit increased activity, more marked with (II). Perhaps this effect is related with the effect of irradiation and (I) and (II) on liver function. Blood serum cholinesterase activity is decreased by 50 and 70%, respectively, under the effect of (I) and (II), and under the effect of external and internal irradiation it is decreased by about 96 and 70%. Blood catalase activity is reduced following irradiation by about 25 and 20%; it barely changes under the effect of (I) and (II). It was concluded that the radiomimetic action of (I) and (II) differs from the effect of irradiation. (Referativnyz Zhurnal–Biologicheskaya Khimiya, No. 22, Nov. 1963)

25155 THE IMPORTANCE OF QUANTITATIVE CHANGES IN THE EXTRACELLULAR WATER SPACE FOR DISTURBANCES OF THE WATER CIRCULATION IN EXPERIMENTAL "INTESTINAL X-RAY DEATH." Zoltan Zsebok and Gyozo Petranyi. Magy. Radiol., No. 1, 1-8(1964).

The gastrointestinal x-ray syndrome was studied in rats by the inulin method combined with ligation of the kidney hilum; 1300 r were administered and changes in the active extracellular space of the whole organism and the individual organs and in the inulin permeability of the gastrointestinal tract were observed after 24, 48, and 72 hr. Two reaction phases were distinguished in the disturbance of the water equilibrium, concomitant with the gastrointestinal x-ray syndrome. In the first, the extracellular space of the organs increased in parallel with that in the entire organism, except for the brain and muscle tissues. In the second, it dwindled from 22 to 10.82% just before the animal's death. The amount of fluid transferred from the organism to the gastrointestinal tract approximately equaled that lost from the extracellular space. The dwindling was uniform, except that the spleen inulin space increased slightly before death, and the small-intestine inulin space decreased only immediately before death. The damaged regulating mechanism could no longer correct the large-scale salt-deficit exsiccosis. The stepped-up inulin permeability of the intestine wall appreciably modified the apparent increase in the measured inulin space of the organism only after 72 hr. (TCO)

25156 CONTINUOUS IRRADIATION WITH TRITIATED WATER OF MAMMALIAN CELLS IN A MONOLAYER. A. H. W. Nias and L. G. Lajtha (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Nature, 202: 613-14 (May 9, 1964).

The effects of continuous low dose irradiation was studied in monolayered HeLa cells using tritium oxide (tritiated water). Radiation dose rates were determined by ferrous sulfate dosimetry using an F value of 12.8. Cell counts were performed on duplicate bottles opened at various times during the growth period. Growth rates in the irradiated samples are indistinguishable from controls until after a period which increases as the dose rate is reduced. Subcultures at 30 rad/day showed an inflection in the growth curve that was repeated in every subsequent subculture, in contrast to the minimal effect during the first culture period at 30 rads/day. Results indicate that 10 to 11 days of culture in tritiated water are required at the 30 rad/day level to show a demonstrable slowing of growth while in subsequent subculturing at the same dose rate a repeated inflection of the growth-curve occurs at about four days after subculturing with a return of growth rate to normal by the eighth day. Data are explained in terms of trypsin damage. (H.M.G.)

25157 THYMUS AND X-RADIATION IN THE TERMINATION OF ACQUIRED IMMUNOLOGICAL TOLERANCE IN THE ADULT MOUSE. Henry N. Claman and Wendy McDonald (Univ. of Colorado, Denver). Nature, 202: 712-13(May 16, 1964).

The effect of whole-body x radiation on the termination of immunological tolerance was investigated in thymectomized and sham-operated mice. Tolerance waned gradually with time in the intact mouse. This effect was retarded by thymectomy but hastened by x ray. However, if the mouse was treated with both thymectomy and radiation, their effects appear to be antagonistic and tolerance wanes at a rate close to that of mice given neither. (H.M.G.)

25158 CHROMOSOME INVESTIGATIONS ON LYMPHOCYTES FROM IRRADIATED PATIENTS: EFFECT OF TIME IN CULTURE. K. E. Buckton (Western General Hospital, Edinburgh) and M. C. Pike. Nature, 202: 714-15 (May 16, 1964).

Blood samples taken from patients at varying time after x-ray therapy for ankylosing spondylitis were analyzed, and cells were classified into three major groups: A cells, cells with no apparent structural abnormality; B cells, cells showing a chromatid gap, chromatid break, or isochromatid gap; and C cells, cells with all other types of structural abnormality. The C cells were further subdivided into those with an unstable form of aberration (C_u) and those with stable forms of aberration (C_s). C_u cells were divided into those likely to be in their first division after radiation exposure (X_1 cells) and those in their second or a subsequent division (X_2 cells). A marked decrease in the proportion of C_u cells between the 48- and 72-hr collections that was partly balanced by an increase in the number of polyploid cells was observed. The number of C_s cells fluctuated but apparently randomly as there did not seem to be any relation to time in culture. X_2 cells

almost doubled between the 48-hr and the 72-hr collections. Provided cells were collected at about 48 hr, the majority of C_u cells was apparently in their first division since irradiation, even up to 5 yr after exposure to radiation. (H.M.G.)

25159 DIFFERENTIAL SENSITIVITY OF TOBACCO MOSAIC VIRUS AND ITS INFECTIOUS NUCLEIC ACID TO FAST ELECTRONS. M. Chessin, R. A. Solberg, and M. Jakobson (Montana State Univ., Missoula). Nature, 202: 830-1(May 23, 1964).

The nucleic acid portion of tobacco mosaic virus containing the infectious unit was separated and the relative sensitivities to fast electrons of the infectious nucleic acid and the whole virus were investigated. After irradiation in aqueous media, the substances were rubbed on leaves of N. glutinosa and the number of local lesions produced were compared with the number produced by unirradiated controls. The infectious nucleic acid portion was found to be more radiosensitive than the whole virus. (C.H.)

25160 ABSENT EFFECT OF UV RADIATION ON ERYTHROPOIESIS OF RATS. Bernhard Tribukait (Karolinska Institutet, Stockholm). Naturwissenschaften, 51: 194(1964). (In German)

The effects of ultraviolet radiation on the total hemoglobin amount and the relative blood value in rats were investigated. There was no significant differences between the values obtained for control and irradiated rats. Ultraviolet radiation was therefore eliminated as an irritating factor in erythropoiesis. (M.C.G.)

25161 HISTOCHEMICAL EXAMINATION OF ASCORBIC ACID CONTENT IN BRAIN TISSUE OF DOGS WITH ACUTE RADIATION SICKNESS. M. S. Gzelishvili and V. M. Abdullaev. Nektorye Vopr. Sovrem. Med., Sb., 128-34(1963).

An investigation was conducted on 14 dogs weighing about 11 kg. Ten of the dogs were submitted to a single dosage of 594 r of general irradiation. The animals were destroyed on the 14th to 15th day after irradiation at the height of radiation sickness. The ascorbic acid (I) content was determined in the various areas of the brain; in healthy dogs it was highest in the cerebellum, mesencephalon, and cerebral cortex. There was considerably less (I) in the medulla oblongata. At the height of radiation sickness there was redistribution and change in the (I) content in the brain. In particular, the (I) content was reduced in the molecular layer of the cerebellum, in the polymorphous cells of the midbrain, in the intercellular space, and reticular substance of the medulla oblongata. A considerable reduction in (I) was observed at the sites of pericellular edema and dystrophic changes. (I) concentration was increased in the endothelial layer of most vessels. (Referativnyy Zhurnal–Biologicheskaya Khimiya, No. 22, Nov. 1963)

25162 THE EFFECT OF IRRADIATION ON THE PROGRESSIVE GROWTH OF METASTASES FOLLOWING INTRAVENOUS INJECTION OF EHRLICH ASCITES TUMOUR CELLS. V. Drásil and V. Juráskova (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Neoplasma, 11: 171-6(1964).

Following intravenous injection of Ehrlich ascites tumor cells, death was observed to set on earlier in mice that had been previously irradiated with a dose exceeding 60 r of x radiation. In the irradiated mice, liver metastases were seen in a large per cent of animals whereas they occur in less than 5% of control animals. This divergent metastatic tumor distribution is considered as the cause of the earlier onset of death in irradiated animals. Liver metastases are probably indicators of radiation damage to this organ. (auth)

25163 IN VIVO EFFECTS OF DIAGNOSTIC X-IRRADIATION ON HUMAN CHROMOSOMES. Arthur D. Bloom (Johns Hopkins Hospital, Baltimore) and J. H. Tjio. New Engl. J. Med., 270: 1341-7(June 18, 1964).

Peripheral leukocyte chromosome studies were done on 95 blood cultures from 20 patients exposed to diagnostic x-ray procedures. Each subject served as his own preirradiation control, and from 2 to 7 cultures were obtained after irradiation. In each of 5 patients exposed at doses between 12 and 35 r, definite evidence of x-ray-induced aberrations was seen within 72 hr after irradiation. Among 8 cases of cardiac catheterization, at 4 to 12 r one patient had fragments 30 min after irradiation. No radioinduced aberrations were seen in 6 patients exposed to 20 to 80 mr. during x-ray examinations of the chest, and none were found in the patient studied with intravenous pyelography, who was exposed to 3 r. The positive effects were in the form of dicentrics, fragments, and a single ring chromosome. In 5 of the 6 cases with aberrations the effects disappeared within two weeks of irradiation; in the sixth patient, abnormalities persisted for two and a half months after irradiation. Evidence that this is a direct effect on the circulating lymphocyte in the G_1 period of interphase is presented. The failure of cell growth in one group of patients was caused by three pharmacologic agents administered parenterally to each patient before irradiation. The results of an in vitro experiment confirmed the inhibitory effect of these drugs on cell mitosis. (auth)

25164 THE EFFECTS OF TOTAL-BODY X IRRADIATION ON SERUM IRON OF RABBITS. Yoshimasa Yoneyama and Ichiro Matsui (Tokyo Univ.). Nisshin Igaku, 49: 673-6(Oct. 1962). (In Japanese)

The time course of serum Fe changes in rabbits were investigated after they received a single whole-body x irradiation dose of 500 r. The serum Fe level was decreased on the first day, elevated on the third day after irradiation, and decreased during the next 2 to 3 weeks. It returned to the preirradiation level 3 to 4 weeks after irradiation. The course of serum Fe changes was discussed in the relation of bone marrow function. (BBB)

25165 BIOLOGICAL ACTIONS OF 14.1-Mev FAST NEUTRONS. Haruma Yoshinaga (Hiroshima Univ.). Nisshin Igaku, 50: 1-9(Jan. 1963). (In Japanese)

Some specific biological effects of fast neutrons on mice are described with special reference to the gastrointestinal tract and hematopoietic system. The neutrons used were generated by the T(d,n)He reaction. Since the T(d,n) reaction neutrons have a monochromatic energy (14.1 Mev) and are not accompanied by γ rays, it was possible to study the biological actions of fast neutrons alone. With electromagnetic radiations (e.g., x rays and γ rays) the ionizing particles are electrons, but with fast-neutron irradiation of biological materials the ionizing particles are mainly recoil protons. This difference in the nature of the ionizing particles causes different biological effects to occur in irradiated mammals with fast neutrons as opposed to x and γ rays. The injury to the gastrointestinal tract of mice exposed to fast neutrons was more severe than the injury caused by x or γ irradiation. On the other hand, hematopoietic injury was negligible in mice irradiated by fast neutrons, whereas a severe injury to the hematopoietic system was seen in mice exposed to x or γ radiation. The respective $LD_{50/30}$ values for 14.1-Mev neutrons, 200-kv x rays, and ^{60}Co γ rays were 570, 640, and 870 rad. (BBB)

25166 EFFECTS OF RADIATION AND CHEMOTHERAPEUTIC AGENTS ON THE INCORPORATION OF THYMIDINE INTO THE CELLS OF EHRLICH CARCINOMA AND RAT BONE MARROW IN VITRO. Janina Jasinska and Adam Michalowski (Oncological Inst., Warsaw). Nowotwory, 12: 321-4(1962). (In Polish)

The direct effects of various doses of x rays and concentrations of Degranol (1,6-bis(β-chlorethylamino)-1,6-deoxy-D-mannitol dihydrochloride) on the incorporation of a specific DNA precursor, thymidine-^{14}C, into the cells of mouse Ehrlich ascites tumor and rat bone marrow in vitro were investigated. Irradiation exerted, quantitatively, an equal inhibitory effect on the incorporation of thymidine into these two tissues. The reaction of the bone marrow and of Ehrlich's tumor to Degranol was different; the cancer cells showed a greater sensitivity in the synthesis of DNA than did the bone marrow cells. (BBB)

25167 COMPLICATIONS FOLLOWING RADIOTHERAPY AND PELVIC LYMPH NODE DISSECTION FOR CARCINOMA OF THE CERVIX; REPORT OF A CASE. David Marshall and Henry Clay Frick, II (Sloane Hospital for Women, New York). Obstet. Gynecol., 19: 542-4(Apr. 1962).

Between 1952 and 1956 at this hospital, all patients with Stage 1 and 2 carcinoma of the cervix received standard Ra application and external x-ray treatment followed by pelvic lymph node dissection about three months after the completion of radiotherapy. A total of 55 patients were so treated, but this procedure was abandoned after the extent and seriousness of the resultant complications became evident. The dissections proved futile, since all patients with carcinoma in the pelvic nodes after irradiation died of their disease. A report of a case so treated, with 8-yr follow-up, is presented. These complications included an infected hematoma and wound abscesses on two occasions, cellulitis and lymphangitis of the lower extremities on three occasions, and an episode of shock with congestive heart failure and pulmonary edema secondary to septicemia and/or pulmonary infarction. Massive elephantiasis of the left leg developed; two major plastic surgical procedures on the left lower extremity were done and further operation may be required. It is suggested that pelvic lymph node dissection after full radiotherapy is contraindicated because of the extent and seriousness of the complications. (BBB)

25168 CHANGES INDUCED BY IRRADIATION ON THE RESPIRATORY ACTIVITY OF NORMAL AND NEOPLASTIC TISSUES IN THE COURSE OF PERFUSION. L. Cappelli, R. Cavaliere, and M. Santoro (Istituto Regina Elena per lo Studio e la Cura dei Tumori, Rome). Oncologia, 16: 281-90(1963). (In Italian)

Experiments were performed with chicken wings perfused with Ringer solution; in some cases a filtrate of Rous sarcoma cells had been injected, producing a rapidly growing tumor. The normal and tumor-bearing wings were irradiated with 200-kv x rays to doses up to 4000 r, and sections of tissue were removed after various intervals and their respiratory activity studied in the Warburg apparatus. Perfusion of the normal wing for a 30-min period did not alter oxygen consumption of the muscle, indicating that the perfusion method maintained normal physiologic activity in the tissue. After this time, the Q_{O_2} fell off rapidly. After 2000-r irradiation, O consumption was depressed, compared with normal tissue, and the rate declined linearly with time, unlike the initial plateau for control tissue. Radiation was less effective in reducing O uptake of sarcoma-bearing tissue than that of normal tissue. This reduction was roughly proportional to the dose for both types of tissue. For normal tissue a dose of 4000-r caused an 80% inhibition of respiration, measured after 60-min perfusion, and a 50% inhibition of tumor tissue. The results show that although the tumor tissue is more radiosensitive than normal tissue, its respiration is less affected by irradiation than that of normal tissue. (BBB)

25169 BASIC EXPERIMENTS ON CELLULAR DEATH. Geminiano De Ocampo, Romeo Espiritu, and Salvador Salceda (Univ of the Philippines, Manila). Philippine J. Surg., 18: 73-84(Mar.-Apr. 1963).

The lethal effect of various chemical and physical agents, including ^{90}Sr β radiation, on chicken corneal cells was studied. Chicken cornea that had been rapidly frozen to −49°C then embryonated for two days showed diaappearance of stromal cells. This method was used to produce chicken and human acellular corneas which could be used clinically for anterior lamellar keratoplasty and experimentally for studies of viability of the noncellular portion of the cornea. When unfrozen cornea was exposed to ultrasonification and embryonated, there were some signs of fragmentation and granulation of the collagen fibers, but the stroma cells did not disappear when the exposure was 5 min, but decreased in number when the application was only 1 or 2 min. In unfrozen cornea stored in 95% glycerol at 25°C there was a gradual decrease of viable cells until all had died by the 25th day. Slow freezing or rapid freezing after dehydration with 20 or 95% glycerol for 2 hr did not kill the stromal cells, although rapid freezing of untreated cornea killed them. Destruction of corneal cells with heat, KCN, and tetanus toxin is also described. When exposed to a ^{90}Sr source giving a dose rate of 42 rep/sec, fresh human corneas showed no change in cells and fibers after one min although a few cells had disappeared as shown by embryonation. After 2-min application, there was evidence of epithelial disintegration, but the stromal cells were intact. More of these cells, however, disappeared on embryonation. Application for 4 and 6 min produced increasingly granular nuclear appearance and disappearance of the cells on embryonation. After 10-min β irradiation, even the fibers began to coalesce and assumed a granular appearance. It is concluded that the manner of cellular death differs with different agents. In natural death from storage, it is by depletion or exhaustion of its component parts; from rapid freezing, by disruption of the vital structures and membranes of the cells by crystal formation and rapid movement of water molecules; from heating, β irradiation, and ultrasonification, by a similar disruption of intermolecular bonds; from formalin, it is by the "fixing" of the intermolecular connection; and from cell poisons, by blocking metabolic processes. (BBB)

25170 SOME PRACTICAL CONSIDERATIONS IN DETERMINING THE PARAMETERS FOR MULTI-TARGET AND MULTI-HIT SURVIVAL CURVES. R. Oliver and B. J. Shepstone (Churchill Hospital, Oxford). Phys. Med. Biol., 9: 167-75(Apr. 1964).

A practical approach is demonstrated to the analysis of experimental survival curves in x-irradiated mammalian and bacteria cells in culture in terms of multi-hit or multi-target models. A linear regression line is fitted to the experimental log survival curve from a fraction of 10^{-1} downwards, and from the extrapolation number and slope of this line, radiation parameters in terms of both models are deduced. These alternative interpretations may then be relevant to consideration of biophysical methods of radiation action. Computer analyses of two unusual survival

curves are included as examples of the use of the method. (C.H.)

25171 DIFFERENCES IN SURVIVAL CURVE SHAPES FOR FORMAL MULTI-TARGET AND MULTI-HIT MODELS. J. F. Fowler (St. Bartholomew's Hospital, London). Phys. Med. Biol., 9: 177-88(Apr. 1964).

Shapes of survival curves calculated from the two basic types of target model are examined. The multi-target, one-hit-on-each-target model is well known and gives rise to survival curves having an exponential form at high doses, and an extrapolation number equal to the assumed number of targets. The other type of model, requiring multiple hits on a single target, has been seldom discussed, and the properties of the resulting survival curves are explored. There are no finite extrapolation numbers, since the curves continue to bend over with increasing dose so that the tangent to the survival curve intercepts the ordinate axis at values which increase progressively with dose. These extrapolation numbers are much higher than the number of hits required to inactivate the target. In a combined model, where m targets, each requiring several hits, must be inactivated, the high extrapolation numbers will become still greater by the factor m. The case where large numbers of targets are present, only a few of which need be inactivated, is also discussed, and this model would also give increased extrapolation numbers. A one-target, multi-hit model with a broad distribution of hit numbers n is sufficient to explain any shape of mammalian cell survival curve so far observed. The multi-hit aspect is important and may be considered to arise from the wide range of energies dissipated per particle track in different microscopic volumes in an irradiated population. (auth)

25172 SEQUENTIAL ANALYSIS IN BIOLOGICAL AND PHYSIOLOGICAL RESEARCH (SIMULTANEOUS STUDY OF THE INFLUENCE OF X-RAY IRRADIATION ON THE GASTRIC TRANSIT TIME IN RAT). J. Doubravsky, O. Kamenicek, S. Komenda, and B. Schober (Palacky Univ., Olomouc, Czechoslovakia). Physiol. Bohemoslov., 13: 96-103(1964).

Sequential analysis was used to study the influence of a single whole-body x irradiation on the gastric passage time of a contrast medium in rats, to verify the hypothesis that such an irradiation prolongs the passage time. Wistar rats were fasted 24 hr and then irradiated with 300 r. Three hours later a suspension of barium sulfate was administered by gastric intubation and passage of the opaque material through the gastrointestinal tract was followed radiographically. Six hours after irradiation a statistically significant prolongation of passage time could be demonstrated in 40 rats. Statistical aspects of the use of sequential analysis in radiobiological research are discussed. (BBB)

25173 EFFECT OF X RAYS AND DEGRANOL ON THE INCORPORATION OF THYMIDINE INTO EHRLICH'S ASCITES TUMOR OF MICE AND RAT BONE MARROW IN VITRO. J. Jasinska and A. Michalowski (Inst. of Oncology, Warsaw). Polish Med. J., 1: 219-23(1962).

A quantitative comparison was made of the immediate, direct influence of ionizing radiation and of an alkylating, radiomimetic agent on the synthesis of DNA in Ehrlich's ascites tumor cells and in rat bone marrow. The incorporation of thymidine into the tissues was used to measure DNA synthesis. A suspension of Ehrlich's ascites tumor cells or nucleated rat bone marrow cells in a fluid medium consisting of 50% glucose-supplemented Hanks' solution and 50% rat serum was irradiated at room temperature with x rays (160 kvp, dose rate 140 r/min). Other samples were treated with Degranol (1,6-bis(2-chloroethylamino)-1,6-deoxy-D-mannitol dihydrochloride, (BCM)). Thymidine-^{14}C was added immediately after either treatment, the cells incubated for 2 hr at 37°C,and their activity counted to measure DNA synthesis. Nucleic acid content of cell suspension was also followed by extinction at 2600 Å, but this method revealed no difference between control and x-ray- or BCM-treated cells. Irradiation inhibited thymidine incorporation to an equal extent in tumor and bone marrow cells, the inhibition being 26, 32, 40, and 44% after doses of 500, 1000, 2000, and 3000 r, respectively. The observed lack of specificity of x-ray action on thymidine incorporation is noteworthy since the compared suspensions contained cells taken from two species of animals and were of a different tissue character, one being a fairly homogeneous population of tumor cells of epithelial origin, and the other a normal, highly nonhomogeneous, hemopoietic tissue. An attempt was made to obtain a mathematical expression for the relation between the dose of radiation and thymidine incorporation into tumor cells, from these and other data from additional experiments with smaller doses of x rays. The results indicated that inhibition of thymidine incorporation is proportional to the logarithm of the radiation dose. It is pointed out that even small doses of radiation exert an inhibitory effect on DNA synthesis, whereas this process has been hitherto often claimed to exhibit low radiation sensitivity. The relation between BCM molar concentrations in the culture medium and the incorporation of thymidine into bone marrow and Ehrlich's carcinoma cells showed that the latter are much more sensitive to small concentrations than hemopoietic tissue. The percentage incorporation-concentration curve for bone marrow is steeper, which results in a similar inhibitory effect of larger concentrations of the drug in both tissues. The straight-line segment of the tumor curve shows a relation between BCM molar concentration and DNA synthesis similar to that for radiation. The inhibition of thymidine incorporation into bone marrow cells under the influence of Degranol is more complex. (BBB)

25174 CHANGES IN THE PERIPHERAL BLOOD IN PERSONS EXPOSED TO IONIZING RADIATION. S. Czaplewski (Oncological Inst., Gliwice, Poland). Polski Tygod. Lekar., 17: 1422-7(Sept. 3, 1962). (In Polish)

The peripheral blood picture was studied in 193 persons (159 women and 34 men) working in the Oncological Institute in Gliwice. The results of the statistical analysis are reported. A significant decrease was seen in the hemoglobin level and of red blood cell and neutrophil granulocyte counts. The decrease of the number of monocytes was less evident. Hypochromic anemia was most frequently observed in the persons examined. (BBB)

25175 EFFECTS OF IONIZING RADIATION ON NUCLEIC ACIDS DURING EMBRYONIC DEVELOPMENT. I. QUANTITATIVE AND QUALITATIVE ANALYSES AT EMBRYONIC "MATURITY." Chong W. Chang and Leo W. Mericle (Michigan State Univ., East Lansing). Radiation Botany, 4: 1-12(Mar. 1964).

Developing barley embryos were shown to be highly radiosensitive. Results are reported from a study of the effects of 450 r x radiation on nucleic acid metabolism in barley embryos and the effect of embryonic stage on radiosensitivity. Results indicate a relation between the alteration of DNA base ratios and abnormalities during embryonic development. Metabolic disturbance as an

expression of tissue incompatibility mediated through radioinduced genetic heterogeneity is considered as a possible cause. (C.H.)

25176 THE MUTATION FREQUENCY IN DIFFERENT SPIKE CATEGORIES IN BARLEY. Ove Frydenberg, Hans Doll, and Jens Sandfaer (Danish Atomic Energy Commission, Research Establishment, Risö, Denmark and Universitet, Copenhagen). Radiation Botany, 4: 13-25(Mar. 1964).

After γ irradiation of barley seeds, a comparison was made between the chlorophyll-mutant frequencies in X_1 spikes that had multicellular bud meristems in the seeds at the time of treatment (denoted as pre-formed spikes) and X_1 spikes having no recognizable meristems at the time of treatment (denoted as post-formed spikes). Comparisons were made between plant groups with different numbers of tillers. This analysis revealed no significant differences. The mutant frequencies were compared in spikes ranked within each X_1 plant according to their number of flowers, a ranking which was shown to reflect the embryological status of the spike. In this comparison it was found that the frequency of mutated X_1 spikes is larger by a factor of 1.5 to 2 in pre-formed than in post-formed spikes, the frequency of mutated X_2 plants among all recovered X_2 plants is the same in pre-formed and post-formed spikes, and the frequency of mutant X_2 plants in mutated X_1-spike progenies (the segregation frequency) is lower by a factor of almost two in pre-formed than in post-formed spikes. (auth)

25177 CYTOGENETIC EFFECTS OF THERMAL NEUTRON RADIATION ON A POLYPLOID GRASS HYDRID. W. S. Boyle (Utah State Univ., Logan). Radiation Botany, 4: 27-31(Mar. 1964).

Seeds of an octoploid hybrid between Agropyron trachycaulum and Hordeum jubatum were radiated with low, medium, and heavy dosages of thermal neutrons. Germination was high in all lots. The percentage survivals at the end of two years for the controls, low, medium, and heavy dosage lots were approximately 98, 16, 7, and 0.4%, respectively. A marked difference was observed in the frequency of dicentric bridges in the initial divisions of the root tips of germinated seeds of the three dosage levels and controls. The quadrivalent frequency in pollen mother cells of all treated lots was not markedly higher than that of the controls. Two distinctive plants, possibly mutants, were detected. The first, in the R_1 generation, possessed a compound leaf and two spikes. The second, in the small R_2 generation, possessed an unusually condensed spike. No chlorophyll-deficient specimens were observed. (auth)

25178 FAST NEUTRON INDUCED LEAF TUMOURS IN BARLEY (HORDEUM DISTICHUM). Sushil Kumar and A. T. Natarajan (Indian Agricultural Research Inst., New Delhi). Radiation Botany, 4: 33-5(Mar. 1964).

Plants with leaf tumors were observed among barley plants grown from seeds irradiated with fast neutrons (100 and 500 rad). Histological studies were made of these tumors to investigate their origin and structure. The significance of these observations in relation to earlier studies on leaf tumors is discussed. (auth)

25179 THE EFFECT OF CHRONOLOGICAL AND PHYSIOLOGICAL AGING OF ONION SEEDS ON THE FREQUENCY OF SPONTANEOUS AND X-RAY INDUCED CHROMOSOME ABERRATIONS. Karl Sax and Hally J. Sax (Univ. of Tennessee, Knoxville). Radiation Botany, 4: 37-41(Mar. 1964).

Both chronological and physiological aging of onion seeds increases the frequency of both spontaneous and x ray induced chromosome aberrations. Both types of aging result in increased sensitivity to x rays. In general, the factors which reduce radiation damage in seeds also promote longer life. This correlation may be of value in studies on aging. (auth)

25180 THE SENSITIVITY OF CASTORBEAN (RICINUS COMMUNIS, L.) SEEDS TO TREATMENTS WITH ETHYL METHANE SULFONATE AND GAMMA RAYS AS MEASURED BY M_1-SEEDLING RESPONSE. R. J. Haarring, A. T. Wallace, A. J. Norden, and S. C. Schank (Florida Agricultural Experiment Station, Gainesville). Radiation Botany, 4: 43-51(Mar. 1964).

The sensitivity arising from separate and combined action of water and ethyl methane sulfonate (EMS) with gamma irradiation was tested on castorbean seeds, in three different experiments. Plant emergence was recorded 10 days, and plant survival and plant height four weeks after planting. Results show that castorbean seeds follow the same trend in response to gamma irradiation for emergence, plant survival, and plant height with changes in seed moisture content as reported for the cereals, barley and oats. Soaking the seeds in water or solutions of EMS also increased their sensitivity to irradiation. Concentrations of 1 and 2% EMS had little effect on the expression of these characteristics except when the seeds were soaked as long as 16 hr. The interaction of gamma irradiation and EMS for these characteristics was relatively insignificant. Low doses of irradiation also stimulated the expression of the characteristics measured as has been reported for other crops. (auth)

25181 INFLUENCE OF SEED MOISTURE CONTENT OF GAMMA-RAY INDUCED MUTATION RATES AT A SPECIFIC LOCUS IN OATS. Alvin T. Wallace (Florida Agriculture Experiment Statinn, Gainesville). Radiation Botany, 4: 53-9(Mar. 1964). (TID-18860)

Seeds of the Victorgrain variety of oats were equilibrated to five moisture levels, irradiated with ^{60}Co γ rays, and the second generation progeny screened for induced mutations at the locus (Vb) controlling the reaction to toxin of the fungus, Helminthosporium victoriae. A series of radiation doses was given at each of the following moisture levels: 2.5, 3.5, 6.8, 10, and 90% water, by weight. The average mutation frequencies, on a panicle basis, observed at these moisture levels were 0.5, 171.7, 14.8, 4.9, and 7.7 $-(\times 10^{-4})$, respectively. These rates thus reached a peak at the 3.5% moisture level and decreased as the moisture level was changed in either direction. This change in mutation frequency in relation to change in moisture levels is in the same direction as changes in radical signal and seedling heights related to changes in barley seed moisture contents as reported by Conger. Such great range in mutation frequency as brought about by changes in seed moisture content can be attributed to the indirect effects of the γ rays. (auth)

25182 THE EFFECT OF ETHYL METHANESULFONATE ON THE GROWTH RESPONSE, CHROMOSOME STRUCTURE AND MUTATION RATE IN BARLEY. Edith E. Froese-Gertzen, C. F. Konzak, R. A. Nilan, and R. E. Heiner (Washington State Univ., Pullman). Radiation Botany, 4: 61-9(Mar. 1964).

Effects of ethyl methanesulfonate (EMS) and x rays on seeds compared by several biological measures in barley. The criteria studied included rate of growth, survival, and fertility of M_1 plants, frequencies of chromosomal aberrations in mitosis of seedlings and meiosis of M_1 spikes, and the frequencies of chlorophyll deficient mutations

among M_2 seedling progeny. The doses of EMS and x-ray treatments chosen reduced the rate of seedling growth and survival to a comparable degree. The reduction of fertility was directly related to the frequency of chromosome aberrations and mutations after x-ray treatment. After EMS treatment, the decrease of fertility was pronounced; however, there was little effect on seedling growth and survival. Also, the frequency of chromosome aberrations observed in EMS treatments was negligible, whereas a high rate of chlorophyll deficient mutations was induced in both M_1 plants and M_2 progenies. Preliminary results indicated that the efficiency of EMS treatments can be further increased when the treatment solutions are buffered and the delayed action of the mutagen is prevented. Physiological damage, e.g., reduced seedling growth and survival, increased with concentration of hydrolysis products in the treatment solutions, except when buffers were added. The damage caused by drying seeds after EMS treatment was reduced considerably by soaking the treated seeds in distilled water before drying. This delayed effect may be due to active agent and/or by-products retained in the tissue after the defined treatment time. (auth)

25183 STUDY ON THE INFLUENCE OF CATALASE ACTIVITY AND RADIOSENSITIVITY OF VICIA FABA PRIMARY ROOTS IN GIBBERELLIC ACID. E. Magdon (Robert-Rössle-Klinik, Academy of Sciences, Berlin). Radiation Botany, 4: 71-81(Mar. 1964). (In German)

Gibberellic acid was shown to increase catalase activity and reduce the radiosensitivity of Vicia faba primary roots. Various concentrations of gibberellic acid were applied before x radiation exposure. A clear reduction in radiation damage was observed in roots treated with concentrations of gibberellic acid ranging from 10 to 75 μg/ml. Possible reaction mechanisms involving catalase-hydrogen peroxide complexes are discussed. (C.H.)

25184 THE PRODUCTION OF CHLOROPHYLL MUTANTS IN AVENA STRIGOSA FOLLOWING X-IRRADIATION AND DIETHYL SULFATE TREATMENTS. P. L. Dyck (Canada Dept. of Agriculture, Ottawa). Radiation Botany, 4: 83-7(Mar. 1964).

The effectiveness of x irradiation and diethyl sulfate in producing chlorophyll mutations in diploid oats, A. strigosa, was studied. A linear relationship was observed between irradiation dose and mutation frequency. Within the range of treatments used, the effectiveness of diethyl sulfate in producing mutations appeared to be similar to that of x irradiation. Furthermore, the spectrum of the different chlorophyll mutations was the same for both mutagens. (auth)

25185 THE EFFECT OF X-IRRADIATION OF BOVINE TESTICLES ON SEMEN. E. L. Gillette, M. L. Hopwood, W. D. Carlson, and F. X. Gassner (Colorado State Univ., Ft. Collins). Radiation Res., 22: 264-75(June 1964). (TID-20154)

The effects of direct x irradiation of the testicles of bulls given in a single exposure of 50, 100, 200, 400, or 800 r are reported. Increases in numbers of morphologically abnormal sperm were seen as early as 5 weeks after irradiation. Decreases in sperm numbers were seen as early as 7 weeks after exposure to 800 r, with longer periods of time required to observe changes in sperm from bulls exposed to lower radiation levels. The physical score of semen decreased 5 weeks after exposure to 800 and 400 r with longer periods of time required to observe changes in semen from bulls exposed to lower radiation levels. Radiation depressed fructolysis rates and oxygen consumption of sperm for indefinite periods at all exposure levels. An increase in the amount of initial fructose in semen was found to correlate with decreases in sperm numbers. Seminal free amino acids and ascorbic acid levels remained relatively unchanged throughout the experiment. The greatest degree of change was observed to occur around 14 weeks after irradiation. Recovery was observed between 30 to 40 weeks after irradiation for most of the criteria studied. Sperm concentration returned to only 65% of preirradiation values at 40 weeks after exposure to 800 r, and this level was maintained until termination of the study 52 weeks postirradiation. Approximately 40% of the spermatogenic tubules of bulls exposed to 800 r a year previously showed damage. Since half the pathologic tubules were showing erratic spermatogenesis, the recovery process may not have been completed at that time. (auth)

25186 EARLY EFFECTS OF X-IRRADIATION ON IN VITRO DNA SYNTHESIS IN MOUSE SPLEEN. N. Fausto, A. O. Smoot, and J. L. Van Lancker (Univ. of Wisconsin, Madison). Radiation Res., 22: 288-304(June 1964).

The histological aspects, weight, and nitrogen, DNA, and RNA contents of spleens were studied 1, 3, and 6 hr after x irradiation. Free and bound β-glucuronidase and DNase were measured in the same time sequence, and a complete tissue fractionation was performed at 6 hr. These studies were correlated with three different determinations measuring different aspects of DNA metabolism, namely: the incorporation of ^{14}C-thymidine into the DNA of spleen homogenates; the incorporation of ^{14}C-TMP into purified boiled DNA incubated in the presence of spleen high-speed supernatant; and the phosphorylation of ^{3}H-thymidine or ^{14}C-TMP by spleen supernatant to yield TTP. The results demonstrate a low incorporation of precursors 6 hr after x irradiation, probably a consequence of cellular death; and a block in DNA synthesis 1 hr after x irradiation which cannot be explained by the release of DNase or by an interference with the activity of the enzymes involved in the last steps of DNA synthesis. (auth)

25187 DOSE RATE: ITS EFFECT ON THE SURVIVAL OF HeLa CELLS IRRADIATED WITH GAMMA RAYS. Eric J. Hall and Joel S. Bedford (Univ. of Colorado, Denver). Radiation Res., 22: 305-15(June 1964).

Experiments are described in which HeLa cells were irradiated with ^{60}Co γ rays at dose rates of 2.37, 16.9, and 44.9 rads/min. The survival curves obtained at the three dose rates are clearly separated, the higher dose rates being more efficient in sterilizing cells. The data are compared with published $LD_{50(30)}$ studies for rats or mice exposed to x or γ radiation at different dose rates. (auth)

25188 MORTALITY AND CLINICAL SIGNS IN SWINE EXPOSED TO TOTAL-BODY COBALT-60 GAMMA IRRADIATION. F. W. Chambers, Jr., C. R. Biles, L. J. Bodenlos, and J. H. Dowling (Naval Medical Research Inst., Bethesda, Md.). Radiation Res., 22: 316-33(June 1964).

The $LD_{50(30)}$ values for ^{60}Co γ radiation for the mid-line exposure doses for swine fell between the previous laboratory and weapons test values, demonstrating that, with adequate dosimetry and controlled conditions, good interlaboratory agreement is possible. As may be seen from the air-dose mortality data, even though the photons are of relatively high energy and the tissue-dose distribution is quite homogeneous, weight (size) must be considered when interpreting data on large animals. With the number of animals used in this experiment, there was no statis-

tically significant difference in the dose-mortality curve due to sex. Although the tissue-dose distribution from the source used in this study was not quite uniform as that discussed in a previous weapons test report, it would be adequate to provide the γ component for a simulated fallout field. The clinical observations indicate that, as has been shown before, death in the 0 to approximately 95% mortality region was due primarily to the hemorrhagic syndrome. A correlation of the mortality, clinical sign, and day-of-death data around the 400-r level points out a possible area for more detailed study, since there was no apparent change in the mechanism causing death, but there was a marked change in the slope of the mortality curve. (auth)

25189 PROLIFERATION OF HEMOPOIETIC COLONY-FORMING CELLS TRANSPLANTED INTO IRRADIATED MICE. E. A. McCulloch and J. E. Till (Univ. of Toronto and Ontario Cancer Inst., Toronto). Radiation Res., 22: 383-97 (June 1964).

The kinetics of proliferation of spleen colony-forming cells derived from transplanted marrow cells were studied by means of two different methods. The results of these experiments indicate that transplanted colony-forming cells do not proliferate in heavily irradiated recipients during the first day after transplantation, but that after this initial lag phase they increase in number in an exponential fashion for at least the next 7 days, with a doubling time of 20 to 25 hr. A transient increase in the D_0 of the survival curve for transplanted colony-forming cells derived from marrow was observed during the post-transplantation lag phase. This increase was maximal approximately one day after transplantation. (auth)

25190 EARLY BEHAVIORAL ANALYSIS OF LOW-DOSE-RATE, HIGH-DOSE GAMMA-IRRADIATED EFFECTS. Gilbert W. Meier (National Institutes of Health, San Juan, Puerto Rico). Radiation Res., 22: 398-403 (June 1964).

Two groups of male mice (n = 10) and two groups of female mice (n = 5) representing, equally, the BALB/c and CF/1 strains, were continuously exposed to γ radiation from a ^{60}Co source for about 15½ days starting when subjects were 30 days of age. Comparable groups of control subjects were sham-irradiated in otherwise comparable conditions. When 70 days of age, all subjects were started on a program of behavioral testing which included a measure of activity and one of the acquisition and extinction of a conditioned avoidance response (CAR). The subjects were 101 days of age at the termination of this program. The results of an earlier study in which the behavioral changes were sought at a much later age (210 days) were confirmed here. The irradiated animals had a higher level of activity but a poorer conditionability as seen in both the acquisition and extinction behaviors. The present results showed that these irradiated-induced behavioral changes are not diminished significantly by the passage of time between the insult and its assessment but are relatively constant in magnitude through much of the animal's life. Although significant strain effects were evident throughout the conditioning data, the absence of interaction effects indicated that the response to irradiation was not mitigated by genetic origin. This study and others discussed strongly suggest that the nature of the effects of irradiation is a function of the age at exposure. An appreciation of this function must be preceded, however, by a thorough understanding of the mechanisms of development and aging in relation to the various behaviors that characterize the organism's life-span. (auth)

25191 THE EFFECTS OF X-IRRADIATION ON MALE FERTILITY IN THE GUINEA PIG. EFFECT OF 75, 150, AND 300 ROENTGENS OF WHOLE-BODY X-IRRADIATION ON SEMEN PRODUCTION. M. Freund and F. J. Borrelli (New York Medical Coll.). Radiation Res., 22: 404-13 (June 1964).

Semen was collected by electroejaculation from 40 guinea pigs for 15 weeks before and for 49 weeks after x irradiation at 0, 75, 150, or 300 r. Depression in sperm output took place during the eighth week after irradiation, and sperm production was depressed for 7 weeks after 75 r, for 21 weeks after 150 r, and for more than 42 weeks after 300 r. Degree of depression and duration of depression in sperm output were directly proportional to the irradiation dose. The data support the concept that x irradiation selectively kills spermatogonia and that the number of cells killed is directly proportional to the dose in the range 75 to 300 r. The data indicate that the period of time required for spermatogonia to complete their development into sperm and for the sperm to pass through the epididymis and vas deferens is approximately 49 days in the guinea pig. (auth)

25192 TISSUE TOLERANCE TO TELECOBALT RADIATION (WITH SPECIAL REFERENCE TO PRIOR RADIATION WITH OTHER RADIATION SOURCES). Ivan Rode (National Oncological Inst., Budapest). Radiobiol. Radiotherap., 3: 167-72 (1962). (In German)

The relative biological effectiveness (RBE) value indicates the relation between radiation effects of comparable radiation sources. A telecobalt therapy unit with 400-^{60}Co was compared with 200-kv x-ray equipment in terms of organ tolerances and symptomatic differences of response. Most of the organs tolerate radiation from the telecobalt source better than when it is delivered by standard x-ray equipment. Skin compatibility is better, but this can only be observed in an open field, because the build-up effect that produces the maximum dose is observed beneath the skin surface. The tolerance of the skin is 70% higher with telecobalt radiation than with x ray. The total dose tolerated from a telecobalt source amounts to 5000 r when it is administered in fractionated doses. If a grid is used with the telecobalt source, there is no increase in tolerance because the secondary radiations produced in the grid materials shift the dose maximum to the surface. The tolerance of the mucosa is less than that of other tissues and is about equal to the tolerance found with standard x ray. After irradiation with x ray, Ra, or other radioisotopes, telecobalt therapy can be utilized for supplementary effective doses of radiation. In order to prevent skin reactions that interfere with, or may prevent, additional exposure to radiation from a telecobalt source, antihistamine salves can be applied to the skin to prevent radiodermatitis. (BBB)

25193 LEUKEMIA FOLLOWING IRRADIATION. F. W. Gunz and H. R. Atkinson (Christchurch Hospital, N. Z. and Dept. of Health, Christchurch, N. Z.). Radiology, 82: 1067-71 (June 1964).

The world literature on radiation leukemogenesis is reviewed for evidence of the relation between the radiation dose and leukemia induction. It is pointed out that there is no decisive evidence of a threshold dose for leukemia induction. It is suggested that age, radiation dose size, dose rate, and degree of fractionation may all affect leukemogenesis. It is concluded that there is insufficient evidence to assess the precise extent of leukemia danger from medical radiation. Criteria for the medical use of radiation are discussed. (C.H.)

25194 REFLECTIONS ON THE USE OF IONIZING RADIATIONS IN MEDICINE. Paul C. J. Roth (Museum National d'Histoire Naturelle, Paris). Rev. Pathol. Gen. Physiol. Clin., 62: 341-52(May 1962). (In French)

The injurious effects of ionizing radiations on human physiology are emphasized as is the increase in human exposure to radiation in modern medical practice. It has been proved that, whereas cell cytoplasm is able to withstand intense irradiation with little damage ensuing, very small radiation doses profoundly affect the nucleus. Criticism is made of the prevalent use of x rays. The increasing evidence of a correlation between incidence of cancer and exposure to x rays is reviewed. In several surveys, 1/5 to 1/2 of the cancers of the thyroid gland were present in individuals receiving x rays for therapeutic purposes. Malignant tumors have developed 2 to 45 yr following the use of x rays for treatment of benign conditions, such as acne, lupus, warts, keloids, boils, benign tumors of the skin, and hirsutism. The cases of lung and bone cancer among radium workers, the appearance of various types of cancer 10 to 15 yr following the use of Thorotrast as a diagnostic tool, and the severe effects produced by the radioactive paint which caused jaw bone necrosis in workers employed in the production of luminescent dials are reviewed. Among the isotopes most injurious to man, ^{131}I, used in diagnosis and treatment of thyroid diseases, may produce the following conditions: dyspnea, myeloid hyperplasia, leukemia, pulmonary fibrosis, and irreversible myxedema. The use of ^{125}I, with a shorter half life, to determine thyroid function, and the practice of surgical thyroidectomy instead of ^{131}I therapy are discussed. Also considered is the incidence of tumors of different types, malignant exophthalmos, and diabetes as a consequence of ^{198}Au implantation in the hypophysis. (BBB)

25195 HISTOPATHOLOGICAL FINDINGS IN RADIATION CATARACT. Tsugihiko Tokunaga (Nagasaki Univ.). Rinsho Ganka, 17: 587-92(May 1963). (In Japanese)

Four cataractous lenses from atomic bombing survivors and three lenses of x-ray-induced cataract were studied histopathologically by the light microscope. In addition, four lenses of rabbit eyes were observed by means of electron microscopy six months after irradiation with a 2000-r x-ray dose. As the result of these examinations and other reports in the ophthalmologic literature, it is concluded that the characteristic histopathologic findings of radiation cataract are the following: fibrillar thickening of the posterior capsule of the lens; aberrant migration of epithelial cells into the posterior capsule of the lens, and abnormally differentiated lens fibers beneath the posterior capsule. (BBB)

25196 HISTOLOGIC STUDY OF OVARIAN FUNCTION IN WOMEN TREATED WITH RADIUM AND TELECOBALT THERAPY FOR UTERINE CARCINOMA. G. B. Battaglia and R. Forleo (Università, Florence). Riv. Ostet. Ginecol., 16: 179-200(Mar. 1961). (In Italian)

Histologic, histochemical, and endocrinologic studies were conducted in 25 women, 22 of whom were treated with intracavitary Ra implantation and three with ^{60}Co radiation of the pelvic region (4000 r). Radiotherapy generally resulted in a decline in urinary excretion of phenolic steroids (estrogens) and an increase in 17-keto steroids and gonadotropin. Histologic examination of ovaries removed surgically later showed marked alteration in morphology in all ^{60}Co-treated cases and most of those treated with Ra. These changes included fibrosis and edema of the stroma and almost total disappearance of follicular and luteal structures. In 7 cases follicles persisted in a hyperplastic cortical stroma, showing marked proliferation of blood vessels that were dilated and filled with blood. The more homogeneous ^{60}Co γ radiation apparently obliterated all follicles in the ovary. Histochemical tests showed persistence of moderate succinic dehydrogenase activity throughout the stroma but very little alkaline phosphatase activity, in contrast to the normal ovary which shows pronounced phosphatase activity in association with endocrine activity. Thus the diminution of urinary estrogen excretion was correlated with loss of functional endocrine cells as seen morphologically. Cytologic studies of vaginal smears also demonstrated radiocastration, especially in cases irradiated by ^{60}Co. (BBB)

25197 EFFECT OF GENERAL ROENTGEN RADIATION ON THE DEVELOPMENT OF TRANSPLANTED TUMORS. M. D. Abdullaev. Sb. Nauchn. Rabot Nauchn.-Issled. Rentgeno-Radiol. Inst. Azerb. SSR, 102-5(1962).

Prior to subcutaneous transplantation of sarcoma M-1, rats were irradiated with a dose of 500 r (voltstabilizer, voltage 180 kv, current–10 ma, filter–0.5 mm. Cu + 1 mm. Al, –60 cm, capacity–25.2 r/min) for 24 hr (1st group), for 15 days (2nd group) and for 2 months (3rd group). The animals of the 2nd group differed insignificantly from the controls: the rats succumbed by the 5th to 7th week with the average weight of the tumor of 14.8 g (controls–16.3 g). The rats of the 1st group succumbed by the 2nd week with the average tumor weight of 9.1 g and those of the 3rd group–by the 3rd to 5th week with a tumor weight of 21.3 g. The insignificant weight of the tumor in the rats of the 1st group is associated with the suppression of the tumor growth by toxic products formed as the result of irradiation and the intensive development of the tumors in rats of the 3rd group with the inhibition of body immunological reactions. In the progeny of the irradiated females the tumors had reached by the 4th to 5th week an average weight similar to that of the 5- to 7-week tumor in the control baby rats. (Referativnyy Zhurnal, Onkologiya, No. 24, Dec. 1963)

25198 INCORPORABILITY OF LABELED AMINO-ACIDS IN PROTEIN OF THE ANIMAL ORGANISM DURING DEVELOPMENT OF RADIATION SICKNESS. M. S. Zaitova and Kh. I. Arifdzhanova. Sb. Nauchn. Tr. Tashkentsk. Gos. Med. Inst., 19: 267-71(1961).

The incorporation of methionine-^{35}S in proteins of rabbit tissues was measured after exposure to 600 r x radiation. A gradual drop in metabolic activity was followed by a return to normal by the 10th day after irradiation. It was concluded that the initial lag in methionine distribution was caused by a lag in protein degradation and that as soon as normal metabolic function was restored the labeled methionine was evenly distributed in proteins of the various tissues. (C.H.)

25199 EFFECT OF PHYSICAL EXERTION ON GENERAL CONDITION OF RATS WITH RADIATION DISEASE AND INJURY OF THE JAW. Vladimir Sicha (Charles Univ., Hradec Kralove, Czechoslovakia). Sb. Ved. Praci, Lekar. Fak. Karlovy Univ., Hradec Kralove, 4: 271-9 (1961). (In Czech.) (cf. NSA 18: 3527)

Investigation of the effect of physical exertion on the general condition and survival of rats treated with a single dose of whole-body irradiation (450 r) showed that both the degree and duration of the exertion are of importance. Physical strain increased mortality in proportion to its degree, and especially when imposed on animals after exposure to ionizing radiation. According to these results, an organism irradiated even by a sublethal dose should be

protected from any physical exertion; this applies especially over the period of latency of the radiation disease. An injury to the jaw further aggravated the symptoms and lethality of radiation sickness, in addition to the effects of overexertion. (BBB)

25200 A CLINICAL AND EXPERIMENTAL STUDY OF THE EFFECT OF SINGLE AND DIVIDED DOSES OF RADIATION ON CATARACT PRODUCTION. George F. Merriam, Jr., and Elizabeth F. Focht (Columbia-Presbyterian Medical Center, New York). Trans. Am. Ophthalmol. Soc., 60: 35-52(1962).

A review is presented of clinical studies on 100 patients with proven radiation cataracts and 73 patients who had received measurable amounts of radiation to the eye, but had not developed lens opacities. In the single-treatment group the minimum cataractogenic dose of x radiation found was 200 r, a dose which resulted in a small, stationary opacity. In the group in which therapy was fractionated from three weeks to three months, the minimum dose that resulted in a lens opacity was 400 r. With greater fractionation, over three months, the minimum cataractogenic dose was 550 r. To investigate further the possibility of a time-dose relation in radiation cataractogenesis, experiments were conducted in rats given single or divided doses of 500 to 2000 r of x rays to one eye. Rat eyes that received 2000 r in a single dose first showed lens opacities about nine weeks after treatment. The group reached an average of 2+ at 12 weeks and, by 19 weeks after exposure, all of the exposed eyes had dense (4+) cataracts (opacities were graded 1+ to 4+). In eyes exposed to 2000 r in three divided doses over six days, the cataracts appeared more slowly and progressed to maturity at a considerably slower rate. The first, early opacities began to appear at about 12 weeks after treatment. At 22 weeks the average for the group was 2+. At about 40 weeks, all of the treated lenses showed 4+ changes. With a single dose of 1500 r, lens opacities were first observed about ten weeks after treatment, and 4+ cataracts were seen at 40 weeks. When this same dose was delivered in three treatments in six days the cataracts were first observed about ten weeks after exposure, and by 70 weeks reached 4+ severity. The eyes exposed to 1000 r in a single treatment showed early (1+) lens changes in 17 weeks, and by 70 weeks all of the lenses were 4+. With this same dose in three treatments over six days, the first opacities were observed in 17 weeks, but required 110 weeks to become 4+. After 500 r, lens changes were first noted at 22 weeks for single as against 35 weeks for the divided doses, but the progression of the cataracts was extremely slow. At 75 weeks, the average for the single group was 1.3+, the divided group 0.5+. The results confirm a time-dose dependency for development of cataracts from irradiation. (BBB)

25201 IRRADIATION OF DONOR BONE MARROW: EFFECTS ON SURVIVAL AND ON CHROMOSOMAL ABERRATIONS IN THE MARROW OF RECIPIENT MICE. Joan Wright Goodman and M. A. Bender (Oak Ridge National Lab., Tenn.). Transplantation, 2: 334-42(May 1964).

Lethally irradiated, $1C3F_1$ mice treated with homologous (LAF_1 or $B6D2F_1$) irradiated (400 r in vivo) bone marrow cells (BMC) survived 90 days as well as did those treated with similar unirradiated BMC. All surviving chimeras from both groups had exclusively donor-type erythrocytes at 90 days. All chimeras tested (19, representing both groups) had donor-type lymph node cells in the 4th month after transplantation. Ten additional survivors, tested 10 months after irradiation and treatment, retained lymph node and red cell transplants. Data were not obtained that would suggest sublethal irradiation of donor BMC suppresses secondary disease. The present findings are in agreement with cited data that the radiosensitivity of immunologically competent cells is similar to that of hemopoietic cells. Thirty-seven chimeras were tested for the presence of recognizable chromosomal aberrations. These were found to be more frequent in the recipients of irradiated marrow than in the recipients of unirradiated marrow. Cloning of cells containing aberrations, evident in both groups, was also more frequent in the animals treated with irradiated marrow. (auth)

25202 THE DEFERRED SURGICAL TREATMENT OF FIREARM WOUNDS WITH RADIATION SICKNESS. T. Chi Pukov. Voenno Med. Delo, 19: No. 1, 32-6(Feb. 1964).

The results of an experiment on 32 rabbits subjected to various doses of x rays are reported. It was concluded that the deferred surgical treatment of firearm wounds in the event of radiation sickness can be successful only if antibiotic therapy has begun in time, i.e., during the incubation period of radiation sickness before the regenerative processes have been destroyed. (OTS)

25203 THE PERIOD OF THE MAXIMUM DEVIATION OF THE LYMPHOCYTE SEGMENT INDEX IN ANIMALS IRRADIATED WITH VARIOUS DOSES OF X-RAYS. G. Sheytanov. Voenno Med. Delo, 19: No. 1, 36-40(Feb. 1964).

Sixty guinea pigs were subjected to doses of 20, 100, 600, and 1000 roentgens. The reduction of the lymphocyte/segment index appeared to be at a maximum between the third and fifth hours after irradiation with the smaller dosages and during the third hour after irradiation with the larger lethal dosages; these periods thus being the most auspicious for prognoses of radiation injuries. A reduction in the index to the vicinity of 0.30 or below during these periods indicates that the radiation dose is mortal or nearly so. (OTS)

25204 ON THE INFLUENCE OF SUPERCOOLING ON IRRADIATED CELLS. Ernst Wendt (Universität, Bonn). Z. Zellforsch., 59: 309-25(1963). (In German)

The effect of hypothermia on the radioresistance of cells was studied in cultures of heart cells from 8- to 9-day-old chick embryos (White Leghorn) and of Ehrlich ascites tumor cells from mice (GN strain). Irradiation of the chick heart fibroblasts at 38°C with 100 to 200 r (100-kv x rays) did not cause visible damage of the cells; 500 to 1000 r caused various morphologic changes in nuclei and cytoplasm; and 3000 to 3500 r killed most of the cells within 24 hr. However, if the cells were irradiated with 3000 r and immediately cooled to 10°C for 20 min, radiation injury was appreciably decreased, as shown by the fact that when these cultures were subcultured, the growth rate was markedly greater than that of control irradiated cells. Cooling the cells before or during irradiation did not seem to affect their radiosensitivity. A similar protective effect of hypothermia was noted with ascites tumor cells. Thus, tumor cell cultures exposed to 1500 r and cooled for 3 hr at 10°C were very effective in producing ascites tumors when injected in mice, whereas cells irradiated at the same dose and maintained at 37°C showed much lower transplantability. This phenomenon was also demonstrated in whole-body irradiated chick embryos: heart tissue from embryos irradiated with 3000 r and cooled for 5 hr at 10°C grew better as heart tissue when explanted in culture medium than tissue immediately removed from irradiated embryos and explanted. However, when the chick enbryo was

irradiated with 3000 r and cooled for 5 hr, it died when the whole embryo was then incubated at 38°. The different results obtained with individual cells and the intact embryo suggest an indirect effect of radiation, perhaps in the form of a circulating radiotoxin, which is responsible for the death of the whole animal. (BBB)

25205 THOROTRAST TUMORS OF THE LIVER. Guenther Moebius and Karin Lembcke (Bezirkskrankenhauses, Schwerin (Mecklenburg), East Ger.). Zentr. Allgem. Pathol. Pathol. Anat., 105: 41-56(Nov. 30, 1963). (In German)

Three new cases are reported in which primary liver malignancies developed in association with deposition of ThO_2 in the organ. The first case concerns a 63-yr-old woman in whome a parenchymal cell carcinoma was found 26 yr after intravenous injection of Thorotrast for diagnostic studies of liver blood vessels. In the second case the 57-yr-old male patient developed a hemangioendothelioma 19 yr following Thorotrast arteriography of the femoral artery. A similar procedure had been carried out in the third patient, a 49-yr-old woman, 32 yr before she was diagnosed as having a liver tumor, shown later to be a malignant endothelioma. Histopathologic studies conducted at autopsy are given in detail for all three subjects, and radioautography in one case demonstrated α-particle tracks emanating from deposits of ThO_2 in the liver. A review of the literature revealed 27 other cases in which Thorotrast accumulation in the liver was accompanied by liver neoplasia; in 15 of the collected cases the tumors originated from epithelium and in the other 15 from endothelium. However, these thorotrastomas show an unusually wide variety of histologic types and several mixed forms were seen. The carcinogenic action of Thorotrast is discussed. (BBB)

25206 AN INVESTIGATION OF AUDIOGENIC SEIZURE PRONE MICE AND RATS AS INDICATORS OF LOW INTENSITY CHRONIC GAMMA IRRADIATION EFFECTS. Julian Porch Cooke. Thesis, College Station, Tex., Texas Agricultural and Mechanical Univ., 1963. 108p.

Investigations of the effects of chronic low level gamma irradiation upon several facets of audiogenic seizure in selected strains and crosses of mice and in Wistar-strain rats were carried out by two methods, viz., irradiation of the mothers during part of the gestation period followed by testing of the offspring and by irradiation of adult animals followed by testing of them. Standardization of the testing technique was achieved by utilization of a variable audiogenerator, tape recorder, amplifier, crossover, speaker, voltmeter, test chamber, and sound level meter. The utilization of a sound stimulus of known intensity and frequency, either pure sine wave or bell, provided standardization for the audiogenic seizure testing. This study has served to help strengthen the belief that the nervous system is not as radioresistant to gamma irradiation as previously believed and that damage to the nervous system, caused by very low levels of chronic irradiation, can be demonstrated as a change in the audiogenic seizure picture. Specifically, this study has shown a relationship between the types of responses of the C57B1xDBA-2 mice and those of the Wistar-strain rats. Prior to prenatal irradiation, the incidence of full seizure (tetany) was higher in the male mice and rats than in the female. Following the administration of 20 r of chronic gamma irradiation delivered to the animals during the first 10 days of gestation, there was an increase in the frequency of full seizure in the F_1 animals. In both male and female mice, this increase was significant below the one per cent level of confidence. In the Wistar-strain rats, however, this increase was significant ($P < 0.01$) in females, but not in males. Since no deaths occurred in the control rats or in the prenatally irradiated rats, it may be concluded that prenatal irradiation did not predispose the rats to a death risk. In mice, however, the increase in the death rate was significant, being below the five per cent and one per cent levels of confidence in males and females, respectively. A similarity between mice and rats resulted when the run-only reaction was considered. Following prenatal irradiation, no important change was displayed by males. In the case of female mice and rats, the animals displayed an increase in the frequency of run-only reactions, $P < 0.01$ in the rat and $P < 0.05$ in the mouse. Very little change was manifested in the latency period following prenatal irradiation. In mice, the changes in latency were not significant; in rats, the mean latency of females was increased in an amount that was significant below the five per cent level of confidence when the data were subjected to an analysis of variance technique. In the case of adult mice which were irradiated with a chronic dose of 20 r, no significant changes were recorded in the seizure picture. Some important changes in the frequency of audiogenic seizure were noted when adult nonseizure prone Wistar-strain rats were irradiated at a low level of chronic gamma irradiation. However, adult rats which had shown some degree of seizure before irradiation displayed no change in seizure pattern afterward. It thus appears that the chronic irradiation of the adult Wistar-strain rat does cause an increase in the frequency of run-only reactions as well as the frequency of complete seizure. The adult animal, however, does not appear to be as reliable an indicator for low level irradiation damage as the prenatally irradiated rat or the mouse. The fact that the chronic administration of 320 r (delivered at a chronic rate of 20 r/day) caused no greater incidences of either type of audiogenic seizure reactions than did lower levels would tend to point to an all-or-none involvement of the nervous system. It suggests, also, that the total amount of chronic gamma irradiation necessary to initiate a change in the seizure pattern lies below a cumulative dose of 20 r. (Dissertation Abstr.)

25207 STUDIES ON THE ANEUPLOIDS OF AVENA SATIVA L. Tien-ding Chang. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 137p.

Six monosomes induced by x rays and designated as A, B, C, D, E, and F in the oat variety Cherokee were studied as follows: 1. Breeding behavior: Only monosome C produced a relatively high frequency of nullisomes, i.e., 6.1%, when selfed, while monosome E gave a frequency of nullisomes as low as 1.2%. No nullisomes were found in the progenies of other selfed monosomes. However, nullisome D and nullisome F were found in the F_2 populations from crosses of monosomes with varieties and species. Based on breeding tests, the transmission rates of the univalent through the pollen and eggs of different monosomes were known to range from 75.0 to 100%, and from 1.3 to 11.5%, respectively. 2. Morphology: Monosomes were generally difficult to distinguish from each other and from Cherokee except monosome F which had the heterozygous fatuoid character. The corresponding nullisomes of monosomes C, D, E, and F were morphologically distinguishable from each other. 3. Karyotype analysis: The univalents present in the monosomes A, B, C, D, E, and F were found not to belong to the three pairs of satellite chromosomes or the one pair of the shortest chromosomes in the somatic chromosomal complement of the hexaploid oats. 4. Intercrosses: Dimonosomes were ob-

tained from intercrosses of monosome C with each of the other monosomes. All showed $19_{II} + 2_I$ at meiosis, meiosis, indicating that monosome C is different from all other monosomes. 5. Crosses with varieties, species, and chlorophyll mutants: Crosses of monosomes and Cherokee were made with Clintland (Purdue), Victoria, Markton, Black Mesdag, "necrotic leaf," "albescent leaf," "netting leaf," homozygous fatuoid (Burnett), Avena fatua (grey seed), Avena fatua (yellow seed), and Avena sterilis maxima. The results indicated the location of a recessive gene for netting leaf on monosome A, a recessive gene for necrotic leaf on monosome B, the dominant crown rust resistant gene L of Landhafer and a recessive gene for non-luminescent seed on monosome D, a recessive gene for albescent leaf on the long arm of monosome E, and a gene or genes for the cultivated type of grain on monosome F. The crown rust resistant genes of Victoria, the stem rust resistant genes A, BC (linked) and D, and a dominant gene for pubescent leaf sheath were not associated with monosomes A, B, C, D, or E. A dominant gene for brown seed was not associated with monosomes B, C, D, or E. From the combined evidences as stated above, it is concluded that the six monosomes A, B, C, D, E, and F are different from each other. Because of the similarity of results obtained in this study and in the early work of Huskins and Nishiyama, the univalent present in monosome F is considered to be the "C" chromosome. (Dissertation Abstr.)

25208 GENETIC CONTROL OF XANTHINE DEHYDROGENASE IN DROSOPHILA MELANOGASTER. Roy Peter Kernaghan. Thesis, Storrs, Conn., Univ. of Connecticut, 1963. 86p.

Xanthine dehydrogenase activity in Drosophila melanogaster is controlled by at least three functional units; rosy (ry), maroon-like (ma-1), and bronzy (bz). Mutation in any one of the units results in a pleitropic phenotype including the absence of xanthine dehydrogenase activity. Twenty-four x-ray induced rosy mutants selected with a chromosome totally deficient for the rosy genetic unit, fail to complement ry^2. These data support the notion that the $rosy^+$ unit conditions a single function in the control of xanthine dehydrogenase activity. Several rosy mutants which occupy separable mutational sites in the rosy unit, as well as $ma\text{-}1^1$, $ma\text{-}1^2$, and bz were analyzed with respect to the presence of an altered enzyme molecule capable of cross reacting with antibody to xanthine dehydrogenase (CRM). Extracts of wild type and mutant genotypes were partially purified with Sephadex. Xanthine dehydrogenase activity was estimated by the increase in optical density at 395 mμ due to the production of reduced thionicotinamide adenine dinucleotide as a measure of the enzymatic conversion of 2-amino-4-hydroxy-pteridine to isoxanthopterin. Mutant extracts were tested for their ability to remove specific anti-enzyme activity from antibody preparations. The anti-enzyme activity remaining following pretreatment was estimated by the addition of active enzyme and subsequent assay of residual enzyme activity. $Ma\text{-}1^1$ and bz were positive while $ma\text{-}1^2$ was negative with respect to CRM activity. Several rosy mutants (ry^1, ry^2, ry^5, ry^9, and ry^{23}) were substantially negative. An anti-$ma\text{-}1^1$ antibody preparation inactivated the wild type enzyme whereas an anti-ry^2 antibody preparation was ineffective. These data are interpreted on a combining subunit hypothesis with contributions from rosy, maroon-like, and bronzy genetic units producing the xanthine dehydrogenase molecule. (Dissertation Abstr.)

25209 THE EFFECTS OF IONIZING RADIATION ON PROTEIN, NUCLEIC ACID AND RIBONUCLEIC ACID SYNTHESIS BY STRAIN L. Yogendra M. Patel. Thesis, Washington, D. C., Catholic Univ. of America, 1963. 71p.

In view of the fact that significant changes in the frequency of nuclear aberrations occur during 24 and 48 hour post-irradiation periods, a study was initiated to examine the effect of a 500, 1000, and 1500 r dose on protein, nucleic acid, ribonucleic acid, and deoxyribonucleic acid synthesis 24 and 48 hours after irradiation. The subcultures were also studied at 96, 120, and 144 hours after irradiation in order to ascertain whether or not metabolic recovery or extended injury characterized the cultures. As an auxiliary experiment, subcultures irradiated with 500 r were again irradiated at 96 hours with an additional 500 r dose. The purpose of this second dose was to determine if radiation effects are additive within the confines of this experimental design. Strain L cells were irradiated with a cobalt-60 source. The protein content was determined by Oyama and Eagle's modification of the colorimetric method of Lowry using a Beckman DU spectrophotometer. The nucleic acid was extracted according to the procedure of Schmidt and Thannhauser, the content being determined using two wavelengths (260 and 280 millimicrons) with the Beckman DU spectrophotometer. It was found that radiation doses of 500, 1000, and 1500 r had a marked inhibitory effect on the ribonucleic acid synthesis. The inhibition of nucleic acid and the deoxyribonucleic acid was also observed at these dose levels. Protein synthesis was least inhibited. The percentage inhibition of ribonucleic acid, deoxyribonucleic acid, nucleic acid, and protein synthesis continued to increase in the subcultures. This extended injury was observed at 96, 120, and 144 hours after irradiation. In the case of the multiple 500 + 500 r dose, the effects of radiation on ribonucleic acid, deoxyribonucleic acid, nucleic acid, and protein synthesis were not additive but intermediary between the 500 and 1000 r irradiated cultures. The protein and deoxyribonucleic acid contents per cell in the irradiated cultures were above the control value of the non-irradiated cells, while the ribonucleic acid content per cell remained relatively unchanged. The present studies indicate that ribonucleic acid synthesis in the Strain L cultures was most sensitive to the radiation doses of 500, 1000, and 1500 r. The possible sites of radiation damage might be either the deoxyribonucleic acid-initiated ribonucleic acid template or the enzymes responsible for the polymerization of the cytoplasmic ribonucleic acid. (Dissertation Abstr.)

25210 STUDIES ON THE CROSS-INDUCTION PROCESS IN ESCHERICHIA COLI K12. Ann Marie Ryan. Thesis, New York, Columbia Univ., 1963. 64p.

Intercellular transfer of the inductive action of ultraviolet irradiation among lysogenic E. coli K12 populations has been previously demonstrated. The process, referred to as "cross-induction," was studied to determine some of the parameters of the phenomenon: its initiation, transfer, specificity and metabolic variability. Cross-inducing activity appears to be unique to ultraviolet irradiation and can be superimposed on the efficient, although non-transferable, induction elicited by mitomycin C and x rays. This suggests a difference in their mechanism of action yet need not imply multiplicity in the terminal inductive event. Both photoreversal and photoprotection of the transferable activity occurs even in donor populations which have already sustained irreparable x-irradiation damages. Bacterial conjugation is essential to cross-

induction as evidenced by a diminution in the productive response concomitant to disruption of the mating process. Donor cells which have been treated with periodate prior to irradiation fail to effect cross-induction; this can be attributed to the destruction of those surface characteristics which are requisite to the formation of the conjugational bridge. Moreover, the efficiency of the mating system is markedly reduced when streptomycin-sensitive donors are exposed to the antibiotic before irradiation; the cross-induction process is, however, less sensitive than the capacity of such donors to produce intrinsic phages. Representative donor strains were analyzed for their cross-inducing efficiency and kinetics of transfer. The sole requirement which has become evident is that the irradiated population be of male sexual type. The response is independent of autonomous F factor since both Hfr and F^+ donors are effective. All donor types whether Hfr, F^+ (λ^+) or F^+ (λ^-) start to transfer the activity early, as seen in interrupted mating experiments, which indicates that no correlation to a particular segment of the bacterial chromosome exists. The efficiency of the system has been shown to be an exponential function of both the F^+/F^- ratio and of the absolute donor population itself. Discontinuous induction or lysis within the mixed cultures was suggested by the pattern of infectious centers during the early period of mating. Metabolic inhibitions imposed on the male prior to irradiation indicate that alteration of protein metabolism but neither balanced inhibition of both RNA and protein synthesis nor modification of the former alone adversely affects donor efficiency. (Dissertation Abstr.)

25211 OCCUPATIONAL CANCER. W. C. Hueper (National Institutes of Health, Bethesda, Md.). p.301-85 of "Handbuch der Gesamten Arbeitsmedizin. Vol. II." E. W. Baader, ed. Munich, Urban and Schwarzenburg, 1961. (In German)

The occurrence of cancer in irradiated patients is discussed and the carcinogenic effect of chemical and physica agents, including ionizing radiations, is reviewed. (BBB)

25212 CHROMOSOMAL ABERRATIONS IN A NATURAL POPULATION OF CHIRONOMUS TENTANS EXPOSED TO CHRONIC LOW-LEVEL ENVIRONMENTAL RADIATION. B. Gordon Blaylock. Thesis, Knoxville, Tenn., Univ. of Tennessee, 1963. 89p.

The salivary gland chromosomes of Chironomus tentans larvae collected from White Oak Creek, an area contaminated by radioactive waste from the Oak Ridge National Laboratory, and from six uncontaminated areas were examined for chromosomal aberrations. White Oak Creek populations were exposed to 230 rads per year or about 1000 times background. Chromosomal maps were constructed to make a general comparison of the banding pattern of the salivary chromosomes of the C. tentans in the East Tennessee area with those of Canada and Europe. These maps were used as a reference in scoring aberrations. Fifteen different chromosomal aberrations were found in 365 larvae taken from the irradiated population as compared with five different aberrations observed in 356 larvae from six control populations, but the mean number of aberrations per larva did not differ in any of the populations. The quantitative amount of heterozygosity was essentially the same in the irradiated and the control population, but there were three times the variety of chromosomal aberrations found in the irradiated area. From this evidence it was concluded that chronic low-level irradiation from radioactive waste was increasing the variability of chromosomal aberrations without significantly increasing the frequency. Five different inversions were found in both the irradiated and control populations; three inversions — 1Ra, 2Lab, and 3Ra — were found at a relatively high frequency and were used in testing the seasonal and geographic distribution. In the White Oak Creek population the frequencies of the heterozygous inversions did not change significantly for a three year period from 1960 to 1962. Also, no changes that could be attributed to seasonal change were detected in the frequencies of these inversions from June through December of 1961 and September through December of 1962. There was no significant difference in the frequencies of these same heterozygous inversions between three local geographic populations of C. tentans. It was concluded that the three inversions which occurred at the highest frequencies are endemic to the population of East Tennessee and have been established in the population for a long time. The frequencies of the standard arrangement, the heterozygous inversion, and the homozygous inversion of 1Ra were significantly different from the expected frequencies as predicted by the Hardy-Weinberg Law. A deficiency of inversion heterozygotes was found which is contrary to the theory of balanced chromosomal polymorphism, but is consistent with a model proposed by Levene, where under certain assumptions genetic equilibrium can be obtained without the heterozygote being superior. The results show that chromosomal polymorphism can be maintained in a natural population without superiority of the heterozygote individuals. (Dissertation Abstr.)

Radiation Effects Therapy and Countermeasures

25213 (AHSB(RP)R-39(p.69-77)) DECONTAMINATION OF THE SKIN. A. W. Lawson (United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England and United Kingdom Atomic Energy Authority. Industrial Group. Calder Works, Calderbridge, Cumb., England).

Contamination of the skin by radioactive substances is not necessarily serious provided the radioactivity is detected and removed promptly. If allowed to remain on the skin, it can present a hazard by direct irradiation of the basal layer of the epidermis and the underlying tissues or by systemic absorption through the intact or injured skin. Maximum permissible levels of skin contamination are defined and decontamination techniques are discussed. (C.H.)

25214 (AHSB(RP)R-39(p.87-93)) THE TREATMENT OF OVER-IRRADIATED SKIN. R. D. Sweet (South Devon and East Cornwall Hospital, Plymouth, England).

Case histories are presented for 11 patients who accidentally received skin burns from x radiation. The treatment of the patients is described. (C.H.)

25215 (AEC-tr-6227/1(p.25-44)) EFFECTS OF WHOLE-BODY AND LOCAL X IRRADIATION ON THE REPRODUCTIVE ABILITY OF MALE RATS IRRADIATED IN THE INFANTILE PERIOD AND CHANGES IN THE FIRST GENERATION. N. V. Savković, D. V. Radivojević, and S. I. Hajduković. Translated from Bull. Boris Kidrich Inst. Nucl. Sci., 15: No. 1, 25-44(1964).

A study was made of the effect of a sublethal dose (600-r x radiation) on the reproductive ability of infantile male

rats after whole-body irradiation, local irradiation of the testes, local irradiation of the head, and simultaneous local irradiation of the head and the testes. The effect of the chemical protectors cysteamine and AET and the restorative effect of DNA extracted from the testes were also investigated. Results of whole-body irradiation showed that sterility occurs in most male rats and the injection of cysteamine and AET before irradiation and of testes DNA after irradiation significantly increased the percentage of fertility. Local irradiation of the head did not inhibit the reproductive ability. Malformations of the progeny in the first generation were investigated and the results showed a reduced growth rate. The delay in growth was observed after whole-body irradiation, local irradiation of the head, and simultaneous local irradiation of the head and the testes. Local irradiation of the testes did not induce changes in the progeny. (auth)

25216 INVESTIGATION OF THE MECHANISM OF THE RADIOPROTECTIVE ACTION OF ETHYL PALMITATE. Ch. Flemming and K. Flemming (Heiligenberg-Institut, Ger.). Arch. Exptl. Pathol. Pharmakol., 246: 86 (1963). (In German)

Further studies were conducted on the previously observed protective effect of this ester in irradiated mice in attempts to elucidate its mode of action. In the present experiments, mice were injected with a 10% (v/v) emulsion of the ester 24 to 48 hr before exposure to 610- to 690-r, whole-body doses of x rays. The protective effect was evaluated by the 30-day postirradiation survival rate. These experiments confirmed that ethyl palmitate causes destructive effects in the spleen and, in effect, produces so-called chemical splenectomy, and also that surgical removal of the spleen acts as a radioprotectant. Thus, survival of the mice was clearly enhanced by excision of the spleen 24 to 48 hr before irradiation. Moreover, it was demonstrated that 24 to 48 hr after intravenous injection of 100 mg, ethyl palmitate produces marked disturbances in spleen, and further experiments showed that small doses of the ester, which did not cause histologically detectable changes in the spleen, also exerted radioprotection. Even intraperitoneal injection of the ester enhanced radioresistance, without producing visible effects in the spleen. In attempts to shed further light on the apparent independence of the effects of the ester on the spleen and on radioresistance, mice were surgically splenectomized 16 days before irradiation; these mice also showed enhanced radioresistance. It was shown that small doses of ethyl palmitate depressed the function of reticuloendothelial cells in liver and spleen, but further experiments will be required to determine whether radioprotection conferred by this ester is mediated via these cells. (BBB)

25217 RADIOPROTECTIVE ACTION AND DRUGS ACTIVE ON THE RETICULOENDOTHELIAL SYSTEM. K. Flemming (Heiligenberg-Institut, Ger.). Arch. Exptl. Pathol. Pharmakol., 246: 87(1963). (In German)

Various lipids, 20 to 50 mg in the form of emulsions, were injected intravenously in mice, and 24 hr later the activity of the reticuloendothelial system (RES) was assessed by the carbon particle method. The mice were also x irradiated with 610-r, whole-body doses and the 30-day mortality rate determined. Of the injected lipids, olive oil, triolein, tricaprin, and 2-oleodistearin stimulated RES function and exerted a radioprotective effect. No quantitative correlation between these two effects was noted; some lipids which markedly affected the RES were only slightly radioprotective, and vice versa. In contrast, ethyl palmitate, ethyl stearate, ethyl oleate, and cholesteryl oleate depressed RES activity but were radioprotective. (BBB)

25218 ON CHEMICAL AND BIOLOGICAL PROTECTION AGAINST IONIZING RADIATIONS. IV. EFFECT OF ADMINISTRATION OF COLITOXIN ON ACUTE AND CHRONIC RADIATION DISEASE. D. Fumarola and D. Giordano (Università, Bari, Italy). Boll. Ist. Sieroterap. Milan., 41: 398-403(Sept.-Oct. 1962). (In Italian)

The radioprotective effect of a polysaccharide fraction isolated from Escherichia coli is reported. The polysaccharide is a constituent of the O antigen of this organism and has as a major constituent, 3-deoxy-D-fucose. In acute experiments rabbits were exposed to 2000-r whole-body doses of x rays; in some rabbits 0.05-mg/kg (body wt) doses of the polysaccharide were injected intravenously for three days before irradiation. All six control rabbits had died by the 6th postirradiation hr, whereas all 10 injected rabbits survived beyond 96 hr and two beyond the 5th day; the mean survival times for the two groups were 3.7 hr and 162.5 hr. In chronic experiments the rabbits were irradiated with 100-r daily doses until death ensued. Control rabbits in this group died on the average after 17.5 days, whereas in the group injected with 0.05 mg/kg polysaccharide intravenously just before irradiation the mean survival time was 38 days. These two groups showed maximum survival times of 22 and 51 days, respectively. The possibility that this polysaccharide may exert its radioprotective effect by stimulating the reticuloendothelial system and antibody-forming tissues is discussed. (BBB)

25219 AN ATTEMPT AT BIOLOGICAL PROTECTION AGAINST ACUTE RADIATION SICKNESS BY MEANS OF ORGANOLYSATES STERILIZED IN AN AUTOCLAVE. Ts. N. Tsochev. Eksperim. Med. i Morfol., 3: No. 1, 56-60 (Jan.-Feb.-Mar. 1964).

The results of an experiment with organolysates from 11 bodily organs in male albino rats subjected to consecutive radiation with sublethal doses of x rays are reported. The protective effect was substantial with only a few of these preparations, which are therefore of no practical interest as independent protection against acute radiation sickness. (OTS)

25220 ABOUT THE POSSIBILITIES OF AN AUTOLOGOUS BONE MARROW CELL TRANSFUSION. N. Henning and S. Witte (Universität, Erlangen, Ger.). Med. Klin. (Munich), 58: 668-72(Apr. 19, 1963). (In German)

Variations in response of the hematopoietic system to chemotherapy or radiation treatment for tumors diminish the range and extent of therapy that can be administered to patients. Use of autologous bone marrow transfusions to increase this range was tested. The study included 10 cases with inoperable malignant tumors who received on an average 380 ml of bone marrow with 5.6×10^9 nucleated cells. One direct result of the marrow cell infusions was a slight increase of the leucocyte values. Marrow aplasia caused by cytostatic agents was corrected within three to four weeks after the marrow cell treatment in four out of six cases, when the marrow cells were given at various times after conclusion of chemotherapy. Hematologic remission was shown by initiation of bone marrow function. It could not be determined whether surviving stem cells were responsible for recovery. Compared to the long-lasting pancytopenia that results from excessive use of cytostatic agents the rapid recoveries observed within two or three weeks indicate a direct relation to the marrow cell infusions. It could not be ascertained whether these effects were due to substitution of proliferating hematopoietic stem cells or to addition of some humoral factor.

The technics of collecting and preserving the marrow cells was not difficult. Some proteinuria and hemoglobinuria were observed because of the unavoidable hemolysis that bone marrow blood undergoes after infusion. This technic increases the possibility for administration of increased dosages of cytotoxic agents and radiation in tumor therapy. (BBB)

25221 DARK REPAIR OF ULTRA-VIOLET INJURY IN E. COLI DURING DEPRIVATION ON THYMINE. Robert C. Shuster (Yale Univ., New Haven). Nature, 202: 614-15 (May 9, 1964).

In bacteria dark reactivation can be demonstrated by recovery of the ability to synthesize acid-insoluble DNA following ultraviolet radiation. The feasibility of this reactivation under conditions of thymine deprivation was in investigated. Inhibition of DNA synthesis was achieved in the triple auxotroph E. coli 15 T−A−U−. To test for reactivation in the absence of DNA synthesis, one group was irradiated before and the other after a 45-min period minus thymine but with arginine and uracil. The rate of uptake in the group irradiated prior to thymine deprivation was taken as index of repair of ultraviolet injury that must have occurred during the deprivation period and in the absence of DNA synthesis. Results indicate that some type of repair can occur that is independent of net DNA synthesis and that can occur under conditions of thymine deprivation. There was a marked increase in the number of bacteria in the nonirradiated controls during the experiment, but the irradiated suspensions showed no increase in cell numbers. Mechanisms of reactivation are discussed. (H.M.G.)

25222 RADIO-PROTECTIVE CHEMICALS AND GENETIC RECOMBINATION IN SORDARIA FIMICOLA. M. W. Miller and E. A. Bevan (Oxford Univ.). Nature, 202: 716(May 16, 1964).

The effects of cysteine, thiourea, and cystamine on genetic recombination as determined by the frequency of second division segregation were studied in Sordaria fimicola. Crossover and non-crossover asci were scored, the percentage of crossover asci for each treatment determined, and the probability of significance calculated. In no case was there any significant difference between the percentage of MII asci for control and treated asci. Neither was there any evidence for biased segregation. Implications for mechanisms of chemical radioprotection are discussed. (H.M.G.)

25223 THE EFFECT OF RADIATION ON SPLENOMEGALY INDUCED BY THE FRIEND LEUKEMIA VIRUS AND ITS MODIFICATION BY ETHYL-N-BIS(2,2-DIMETHYLETHYLAMIDINOPHOSPHORO)-CARBAMATE (AB-132), ACTINOMYCIN D, AND AET. W. Regelson and O. Pierucci (Roswell Park Memorial Inst., Buffalo). Radiation Res., 22: 368-82(June 1964).

A new biological indicator of radiation damage is proposed. It exploits Friend leukemia virus-induced splenomegaly as the parameter. The method permits the use of nonlethal doses of whole-body irradiation. Its applicability for study of radiation-modifying drugs was tested with AB-132, actinomycin D, and AET. Significant but transient potentiation occurred when AB-132 was administered with radiation. Independent action was demonstrated for actinomycin D and radiation. Radioprotective action for AET was seen. These experiments indicate that FLV splenomegaly may be of value as a parameter to aid in the study of drugs that modify radiation effects. (auth)

25224 RADIOPROTECTION BY p-CHLOROMERCURIBENZOATE OF HAPLOID, DIPLOID, AND TETRAPLOID YEAST. Victor W. Burns (Stanford Univ., Calif.). Radiation Res., 22: 414-18(June 1964).

p-Chloromercuribenzoate protects diploid yeast from x radiation, but not haploid or tetraploid yeast. Protection is conferred under anoxic conditions as well as under aerobic conditions. Maximum protection is afforded by p-chloromercuribenzoate at concentrations of 10^{-5} M or less. (auth)

25225 SURVIVAL RATE OF RATS IN ACUTE RADIATION SICKNESS PRODUCED BY IRRADIATION WITH SCREENING OF VARIOUS PARTS OF THE BODY. G. A. Dzhafarov. Sb. Nauchn. Rabot Nauchn.-Issled. Rentgeno-Radiol. Inst. Azerb. SSR, 193-200(1962).

Rats were subjected to x irradiation at a dose of 900 r (DL_{100}). Screening of the upper part of the abdomen, which contains the spleen, adrenals, liver, solar plexus, and a part of the intestine, was accompanied by an increase of the rate of survival to 46.6% and a considerable increase in the length of life. On screening of the lower part of the abdomen, the rate of survival did not change significantly; however, the length of life was increased considerably, possibly because of a lower degree of injury to the intestine. On screening of the chest there was only a small tendency towards an increase in the number of surviving animals (6.6%), apparently because of the protection of some of the bone marrow. Screening of the head produced no effect whatever. (Referationyy Zhurnal, Biologiya, No. 17, Sept. 1963)

25226 ON THE PROTECTIVE EFFECT OF ACTH AGAINST EXPERIMENTAL MOUSE LEUKEMIA−RF-TYPE MOUSE LEUKEMIA INDUCED BY RADIATION. Ichiro Iwasaki, Minoru Yasuda, Shigeru Arimori, and Yasuo Kawanishi (Okayama Univ., Japan). Sogo Igaku, 20: 226-30 (Mar. 1963). (In Japanese)

Experiments demonstrating that treatment with adrenocorticotropic hormone increases the survival time of mice developing leukemia after irradiation are reported. (BBB)

25227 THE ACUTE RADIATION SYNDROME. Erik Poppe. Tidsskr. Norske Laegeforen., 83: 946-50(June 1, 1963). (In Norwegian)

A review is given of the symptomatology, diagnosis, and treatment of the acute radiation syndrome. (BBB)

25228 SOME METHODS OF STIMULATING FORMATION OF LEPTOSPIROSIS ANTIBODIES IN IRRADIATED RABBITS. V. P. Morozova. Tr. Voronezhsk. Gos. Med. Inst., 45: 117-22(1962).

Administration to rabbits of a large dose of heterogenous serum (15 ml) 13 to 25 days before irradiation followed by immunization with anti-leptospirosis depoted vaccine two days after exposure to the action of radiation considerably increased the rate of survival of the animals when radiation sickness developed, but inhibited the formation of antibodies to the vaccine that was introduced. A small dose of serum (2 ml) administered during the same period under the same conditions did not increase the radiation resistance of the rabbits, but preserved the capacity for the formation of antibodies on introduction of antigen after irradiation, although a lowered formation of antibodies and a delay in the increase of their titers was observed in comparison with animals that had been immunized and irradiated without stimulants. Introduction of gelatin to the rabbits for three days before irradiation increased the resistance of the animals to the effects of radiation and preserved the capacity for the formation of antibodies, which was lower than that of animals irradiated without preliminary administration of gelatin and animals that had

been immunized. Annular screening of abdominal organs of rabbits immunized with depoted anti-leptospirosis vaccine two days after irradiation increased the rate of survival of the animals on development of radiation sickness and resulted in the formation of a considerable amount of antibodies. (Referativnyy Zhurnal, Biologiya, No. 17, Sept. 1963)

25229 OXYGEN EFFECT AND POST-RADIATION REPARATION AFTER THE ACTION OF X-RAYS ON THE BACTERIAL CELL. E. A. Val'dshteyn (Cytology Inst., Leningrad). Tsitologiya, No. 4, 460-1(July-Aug. 1963).

Cultures of E. coli were simultaneously irradiated with x rays and subjected to a continuous flow of air or N (no O present), and then inoculated on meat-peptone agar or minimal medium M-9 and grown at 19, 37, and 45°C. At 19°C, survival was minimal and there was no reparation. At the other temperatures there was always less reparation when O was present. In line with evidence that the postradiation reparation system is located in the cytoplasm, it is assumed that O increases radiation damage primarily of the cytoplasmatic structures. (auth)

25230 FERTILITY OF GUINEA PIGS AFTER LOCALIZED GENITAL AND LETHAL WHOLE-BODY X RADIATION (550 R) AND USE OF RADIATION PROTECTION AGENTS. Ed. Gabler (Wilhelminenspital, Vienna). Wien. Z. Inn. Med. Grenzg., 43: 515-24(Dec. 1962). (In German)

After 550-r whole-body x irradiation, fertility was almost completely destroyed in female guinea pigs, but if the animals received calf serum, human gamma globulin, bone marrow transfusions, or spleen cell transfusions within 30 min, they recovered their fertility. When bone marrow or spleen cell transfusions were given, fertility was completely regained, and the average number of young per litter was the same as in unirradiated control animals. The offspring were free of radiation injury. Following localized genital irradiation with 550 r, without treatment, recovery was decreased. The average number of young per litter was about half of normal; the offspring were smaller, they appeared unhealthy, and some were stillborn. In the second litter born after radiation exposure, 40% were sterile, but the average number of fertile animals increased. Calf serum and gamma globulin were less effective than bone marrow or spleen extracts, because the average litter size was only $^1/_3$ of normal. Also, the time of birth of the litters was delayed 3 weeks longer. The effectivity of the spleen and marrow cells to restore fertility is probably due to their DNA content. The action of calf serum and human gamma globulin is probably due to effects on the recovery of marrow function and on spleen cells. It is probable that only after recovery of these cells that regeneration of genital function occurs. Recovery of the young from localized genital radiation, and of the adult females, treated by protective agents, as shown by body wt increases, is only partial after one month. Many of the young are blind, lame, or exhibit central nervous system damage. (BBB)

25231 ON THE MECHANISM OF ACTION OF RADIATION PROTECTION THROUGH OLIVE OIL. A. Locker (Osterreichische Studiengesselschaft fur Atomenergie GmbH, Vienna). Z. Ges. Exptl. Med., 137: 587-96(1963). (In German)

The influence of olive oil on total metabolism, body temperature, and cell respiration was examined in male mice of two weight groups. In mice of weight 15 g a dose of 1.0 ml/20 g produces a reduction of total metabolism lasting up to three weeks. Body temperature is lowered only immediately after the injection (period of observation two hr), during which period the total O_2 consumption also decreases rapidly and later rises again. In the case of older animals (25 g) no metabolic change was observed over a period of a week. Cell respiration in liver, spleen, and other cells was not definitely altered in vivo over a period of seven days. After irradiation of mice with 800 r, no change was observed within a week in total metabolism and body temperature. Animals treated one day before irradiation with 1.0 ml/20 g olive oil showed approximately the same metabolic decrease as animals which were not irradiated, and later a decrease in body temperature as well. In small mice mineral oil in the single dose of 1.0 ml/20 g has the same effect over a seven-day period as olive oil on the total O_2 consumption. In addition to the confirmation of a weak radiation protective action of olive oil at 800 r, a protective action of mineral oil was also determined. (BBB)

25232 OPERATION FOR A LARGE RADIUM FISTULA. M. A. van Bouwdyk Bastiaanse. Zentr. Gynaekol., 85: 721-5(May 25, 1963). (In German)

Radium fistulas are necrotic fistulas that can progress over long time periods and become enormous. Operative repair is possible only after the necrotic processes have ended. In order to bring about cessation of the progressive necrosis in a patient with a vesicovaginal fistula, a corticosteroid, prednisolone, was given twice weekly. The individual dose amounted to 10 mg, and was introduced into the bladder as a solution. At the same time 5 mg of prednisolone was given orally three times a day. After seven weeks of treatment the necrotizing process was halted so that the necessary operation became possible. This was performed successfully four weeks after administration of the hormone was stopped. The surgical repair of large bladder fistulas resulting from Ra treatment is generally regarded as difficult, but for surgeons who have good vaginal surgical technic it is not so difficult if several points are observed. These are: the operation must be confined to the vaginal area, the operational area must be visible and accessible, the thigh must be flexed to the rear, and there should be no tension on the thread that retains the broad wound surfaces. Catgut is suitable. Intensely irradiated tissues are very taut, fibrotic, and avascular. Therefore the fistula cannot be closed by overlapping the bladder walls, although this is absolutely necessary for healing. In the operational method used, normal nonirradiated tissue, made into pedunculated folds over the layer of stitchings, were formed from healthy surrounding tissue and fixed onto the bladder walls. (BBB)

Radiation Hazards and Protection

25233 SKIN DECONTAMINATION. H. Scheel (Staatliche Zentrale fur Strahlenschutz, Berlin). Kernenergie, 7: 197-203(Apr. 1964). (In German)

Radiation injuries from adsorption of radioisotopes on the skin are considered. Mechanisms for percutaneous sorption of radioisotopes are described. Protection of skin from contamination and the general principles of skin decontamination are discussed. Uses of soap, complex formers (such as EDTA), titanium dioxide, potassium permanganate, and acids as decontamination agents are described. (55 references). (M.C.G.)

Radiotherapy and Radiodiagnosis

25234 (SGAE-IB/IA-2/1964) DENTALDURCHLEUCHTUNG MIT HILFE EINER RADIOAKTIVEN STRAHLENQUELLE. (Dental Fluoroscopy with the Aid of a Radioac-

tive Radiation Source). K. Duftschmid (Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf, Austria). [nd]. 23p.

Experiments in dental fluoroscopy were reported using a small radioactive irradiation source, instead of an x-ray tube. The source can be inserted into the mouth and the radiation directed on to an image intensifier tube. The radiation source which is derived from ^{147}Pm has a bremsstrahlung spectrum similar to that obtained using a diagnostic x-ray tube with a voltage of 80 kv. A γ dose rate of 0.7 r/hr at a distance of 3 cm is given and the brightness of the image is sufficient to be viewed in daylight. The screening technique was compared with conventional film radiography and has the advantage of immediate visual control of extractions, rootfillings, and yaw operations, as well as saving time otherwise necessary for developing x-ray films. A further advantage is that the radiation dose is reduced to approximately 1/100 of that normally received. (auth)

25235 GRENZ RAY IN THE TREATMENT OF ACNE VULGARIS: CONTROLLED STUDY. Wayne L. Wright (Univ. of California, San Francisco). Arch. Dermatol., 89: 417-18(Mar. 1964).

In view of the possible hazards involved and the dubious value of using radiation in benign conditions, attempts were made to verify an earlier report claiming therapeutic effectiveness of soft x rays in patients with acne. Ninety-five patients with acne were treated with 1200 r of Grenz-ray therapy in divided doses of 200 r each. After six months' follow-up, no significant improvement was noted, and increased pigmentation was a side-effect encountered, especially in darker-skinned individuals. Subjective evaluation of the results in 45 acne vulgaris patients indicated that 38 believed that the treatments had improved their skin condition, but over half thought that the sham-irradiated side of their face had improved more than the side actually irradiated. Twenty-five patients with acne conglobata responded to the same questions similarly. The investigator noted no difference in improvement between the treated and untreated sides. The only visible change in the skin was the increased pigmentation on the treated side. This increase in pigmentation was particularly prominent in brunettes, and it is suggested that patients should be warned about this before Grenz ray is given to exposed areas in people with darker-than-average skin. In all patients the pigmentation had faded by the 6th month observation period. It is concluded that Grenz ray is not of value in the treatment of acne, either alone or as an adjunct. (BBB)

25236 NEW SCINTILLATION CAMERA ADVANCES MEDICAL DIAGNOSIS. Atomics, 17: No. 3, 50-1(May-June 1964).

A new type of scintillation camera that can be used to detect tumors and visualize internal organs in humans and animals is described. Known as the Multiple-Aperture Scintillation Camera, it not only produces photographs upwards of ten times faster than scanning-type apparatus used before, but provides more complete information than the scanner. The new instrument is capable of picturing on Polaroid film two-dimensional distribution of radioisotopes and then following the rate at which the isotopes may move into and out of such organs as the liver, thyroid, and kidney. Actual photographs of brain tumors provide additional valuable data as to their size and location. (P.C.H.)

25237 PROBLEMS POSED BY THE PATIENT WITH AN ENLARGED THYROID. K. Schelstraete and P. M. Van Vaerenbergh (Rijksuniversiteit, Ghent). Belg. Tijdschr. Geneesk., 19: 455-67(May 1, 1963). (In Dutch)

Theoretical and practical aspects of uptake of ^{131}I by the thyroid gland, with particular reference to the diagnosis of thyroid disease, are discussed. (BBB)

25238 CLINICAL BONE MARROW SCANNING WITH RADIOISOTOPES. C. Lowell Edwards, G. A. Andrews, B. W. Sitterson, and R. M. Kniseley (Oak Ridge Inst. of Nuclear Studies, Tenn.). Blood, 23: 741-56(June 1964).

Thirty-two series of bone marrow scans were performed on 29 patients with blood dyscrasias or cancer. The scans were made with three colloid preparations, the most satisfactory of which was colloidal ^{198}Au. Distinct pictures exhibiting the distribution of hematopoietic marrow were obtained with the ORNL Research Scanner. Local lesions within the marrow organ were demonstrated and confirmed by histologic studies. Variations in the size and distribution of the marrow organ were shown in a graphic fashion which have hitherto been impossible. The doses of ^{198}Au required, although rather large, did not produce any detectable early radiation effects. The possibility of harmful effects years after administration limits the present method to selected patients. Bone marrow scanning using the procedure reported here can be of considerable assistance to the investigator, and with improvements anticipated in the technic, it may find its place as a practical clinical procedure. (auth)

25239 PROBLEMS CONNECTED WITH USING RADIOACTIVE ISOTOPES IN WOMEN OF CHILDBEARING AGE AND PREGNANT WOMEN. V. Hlavaty and Z. Dienstbier (Charles Univ., Prague). Casopis Lekaru Ceskych, 103: No. 16, 74-80(Apr. 17, 1964).

Uses of isotopes for diagnostic purposes are discussed. Experience with intrauter irradiation of the embryo is described, along with influence of x ray during pregnancy. Comparison of x-ray methods of examination and methods using radioisotopes is reviewed. The importance of making sure, when possible, whether a patient is pregnant before using certain examination methods is stressed. (TCO)

25240 NEW METHOD OF SURGICAL TREATMENT OF CANCER OF THE LUNG WITH ADMINISTRATION OF ROENTGEN-RADIUM THERAPY DURING OPERATION. I. T. Shevghenko (Radiological-Oncological Research Inst., Kiev). Diseases Chest, 45: 36-9(Jan. 1964).

This new method combining x and γ radiation for treatment of lung cancer involves an improvement in radiation therapy whereby the field of irradiation is reduced, with better centering of the radiation beam, and minimal irradiation of the surrounding tissues. Safety of the method was demonstrated by experiments performed on 20 dogs and 165 rabbits. No radiation complications were observed, and the wound in the region of the anastomosis, the large vessels which were ligated, the stump of the bronchus, and the skin healed without any untoward effects after a total dose of 320 rad. Clinical observations of 70 patients with cancer over a period of 3 yr also attest to the effectiveness of the method. It is carried out as follows: at the time of pneumonectomy, lobectomy, or segmental resection of the lung, ^{60}Co in an amount of 21.8 to 30.2 mg in a rubber tube (radium holder) is fastened with catgut stitches to the mediastinum, or to stumps of the bronchi and vessels, or to the root of the lung and is left in the wound for 24 to 48 hr. The total dose given is 3000 to 9000 rad. This procedure is followed by x-ray therapy over the affected lung field. Histories of two patients are described to illustrate the effectiveness of the method for treating primary or metastatic cancer of the lung. (BBB)

25241 SAFE PROCEDURES IN RADIATION. Norman Simon (Mt. Sinai Hospital, New York). J. Oklahoma State Med. Assoc., 56: 425-30(Sept. 1963).

Radiation hygiene applicable to the practice of radiology for diagnostic and therapeutic purposes is discussed. Evidence relating to the possible leukemogenic action of radiation is reviewed with reference to the increase in leukemia incidence in American radiologists, leukemia incidence in patients treated with radiotherapy for arthritis, leukemia incidence in survivors of atomic bombing, leukemia incidence in children irradiated for enlargement of the thymus, and leukemia incidence in children irradiated in utero during pelvimetry. It is concluded that leukemia is induced by radiation at high doses, but not necessarily at low doses. No increase in leukemia was found in the survivors of radium-treated cancer of the cervix, which suggests that the distribution of radiation in the body may be an important factor in leukemogenesis. Doses of radiation received in the diagnostic use of x rays are too low to account for a discernible increase in the incidence of leukemia; however, there is no apparent threshold below which mutations do not occur. For this reason the physician should protect the gonads of young individuals from radiation. In comparison with the other main source of genetically significant radiation, the gonadal dose from medical radiology is about 1/5 of the annual dose to gonads from natural background radiation. Surveys made on the dose to gonads from diagnostic x rays show that this dose is decreasing as physicians utilize safe modern procedures for protection of the gonads. The principal method of reducing the dose to gonads is the restriction of the radiation beam to the part examined. Restrictive cones and collimating devices should be used routinely to avoid irradiation of the gonads and to decrease the dose to the bone marrow. One beam-restricting device has a variable diaphragm which defines a rectangular beam and which contains a light beam for accurate localization of the part to be irradiated. The gonads can be shielded with lead or lead rubber in many instances in both females and males to prevent these organs being included unnecessarily in the beam of radiation. Fluoroscopy accounts for some of the gonad dose and this is kept to low levels by dark-adaptation of the eyes and by use of new fluoroscopic screens. Further reduction of gonad dose and of marrow dose to both patient and physician can be achieved by intensifying the fluoroscopic image electronically. High-speed intensifying screens, films, and developers also cut down the dosage. (BBB)

25242 URINARY TRACK RADIOGRAPHY WITH STRONTIUM LACTATE CONTRAST MEDIUM. Iv. Tabakov. Khirurgiya (Sofia), 16: 303-6(1963). (In Bulgarian)

The use of Sr lactate for visualizing the urinary tract radiologically is described, and tests conducted with it in rabbits and humans are described. It was found to be less irritating to mucous membranes than some iodo-compounds used for contrast media, such as Na iodomethanesulfonate (Methiodal), and it is less expensive than these compounds. Its lower opacity makes it less useful than these compounds for retrograde pyelography, but it gave good results in urethrography and cystography. For use in renography, only the chemically pure Sr lactate should be used; the optimal concentration for an aqueous solution was 30%. (BBB)

25243 PHENYLBUTAZONE AND RADIOTHERAPY. Christopher Howard. Lancet, 2: 1277(Dec. 14, 1963).

One case is reported in which phenylbutazone treatment (for arthritis) appeared to prevent the usual side-effects when the patient was given ^{60}Co radiotherapy for an invasive carcinoma of the neck; however, no objective data are supplied to support this claim. (BBB)

25244 ANALYSIS OF THE CAUSES, FAILURES, AND COMPLICATIONS IN THE TREATMENT OF CANCER OF THE URINARY BLADDER BY MEANS OF TELECOBALT-60. Michael Wasilewski and Zbigniew Malinowski (Inst. of Oncology, Warsaw). Nowotwory, 12: 301-8(1962). (In Polish)

Treatment of complications and the early results of therapy are discussed with reference to 101 patients treated for cancer of the urinary bladder by means of ^{60}Co γ radiation. The patients were classified according to Wallace's categories and grouped according to previous treatment prior to ^{60}Co irradiation. The treatment was carried out by employing an Eldorado apparatus and 5-port technique. Nine patients did not complete the planned radical treatment because of co-existing disease or inflammatory symptoms. It was found important not to irradiate patients before complete consolidation of the scar after cystostomy. During irradiation, difficulties were encountered in maintaining regularity of treatments because of narrowing of the urethra. In selected cases irradiation was used after surgical restoration of normal lumen size of the urethra. A period of observation of at least 6 months after treatment was possible with 85 patients (77 with radical treatment and 8 palliative). The early results depended upon how advanced had been the neoplastic process before treatment. The doses employed were gradually increased as experience was gained to a minimal dose of 5000 to 5500 r. Maximum doses of 6500 to 7000 r did not bring about any special complications. (BBB)

25245 RADIATION RECIPROCITY IN A SCATTERING MEDIUM: AN EXPERIMENTAL STUDY. F. O'Foghludha (Medical Coll. of Virginia, Richmond). Phys. Med. Biol., 9: 155-65(Apr. 1964).

Three experimental methods of determining integral absorbed dose (Σ) or total absorbed energy are at present available. In the so-called exposure-mapping procedure, the exposure is measured at a large number of points within the irradiated body and Σ is then evaluated from a knowledge of the volumes enclosed by the various iso-exposure surfaces so determined. The method is tedious, especially in moving-beam situations. The alternative chemical methods are relatively insensitive, requiring exposures of order 10^3 r and their accuracy is influenced by the presence of impurities. Lastly, there are special devices such as the cross-sectional chamber (Rossi, Liebowitz and de Friess 1959) and the celluloid man (Grimmett 1942) but they are of fixed sizes and shapes. The application of the well-known radiation reciprocity principle (King 1912) to the measurement of Σ in typical radiotherapeutic situations was investigated. The reciprocity principle states that the integral absorbed dose in a body exposed to a gamma-emitting source is directly proportional to the exposure rate which would be observed at the source position if the source were removed and gamma-emitting material of the same kind were distributed uniformly throughout the body. It is pointed out that the reciprocity principle may hold approximately even when Compton effect is the predominant radiation interaction. Rough calculations supporting this view are reported. Experiments in which the integral absorbed dose Σ is determined in slab-like water phantoms exposed to collimated gamma sources are described. The exposure rate E at the positions previously occupied by the sources when the phantoms are filled with radioactive material was measured in separate experiments, and the ratio Σ/E is shown to be suffi-

ciently independent of the geometry to permit use of the principle in clinical work. The application of this result in rotation therapy and whole-body irradiation is pointed out. (C.H.)

25246 THE PAST, PRESENT, AND FUTURE OF RADIOLOGY. H. R. Schinz. Praxis (Bern), 52: 982-5 (Aug. 8, 1963). (In German)

The history of the development of medical radiography and medical applications of ionizing radiations is reviewed, and some problems relating to radiation measurement and unitage and possible hazards to human health are discussed. (BBB)

25247 A RADIOLOGIST LOOKS AT RADIATION PROTECTION PROCEDURES. L. Henry Garland (Univ. of California, San Francisco and San Francisco General Hospital). Radiology, 82: 963-71(June 1964).

The biological effects of radiation in man are reviewed with emphasis on effects on the gonads. Radiation protection of patients during diagnostic radiographic examinations is discussed. It is pointed out that surveys show that at least half of the x-ray examinations in this country are performed by nonradiologists, while only radiologists are required to have training in radiation use and protection. The registration of x-ray machines and radiation sources is suggested as a possible protective measure. (C.H.)

25248 RADIATION CONTROL: STANDARDIZATION VERSUS FREEDOM. Reynold F. Brown (Univ. of California, San Francisco). Radiology, 82: 972-6(June 1964).

The present status of radiation control of the physical standards of x-ray equipment and accessories used in the practice of medicine in the U. S. is reviewed. Proposals for state regulation of x-ray equipment and operators of such equipment are discussed. (C.H.)

25249 LEAKAGE RADIATION THROUGH LEAD GLASS IN FLUOROSCOPIC SCREEN ASSEMBLIES. E. Dale Trout and John P. Kelley. Radiology, 82: 977-85(June 1964).

The recommendations of the National Committee on Radiation Protection and Measurements (NCRPM) concerning the Pb equivalent of Pb glass over fluoroscopic screens are discussed in terms of maximum permissible radiation doses to the lens of the eye. The difficulties encountered in measuring radiation above a fluoroscopic screen and the contribution of scattered radiation to the total dose are discussed. The radiation transmitted through Pb sheets of thicknesses in the range of the recommended Pb equivalents was measured in an effort to bring into a single reference information relative to the transmitted radiation through a fluoroscopic screen. The measurements were made with the chamber at a position where the eye would usually be when using a fluoroscopic screen assembly. Data were taken with kilovoltages from 100 to 150 kvp with no phantom and with a unit density phantom of up to 8-in. thickness. The Pb glass was removed from the screen frame and the Pb sheet inserted in its place. The data may be used to calculate the dose to the eye for various conditions of operation and workload when the fluoroscopic equipment system complies with the recommendations of the NCRPM as stated in Handbook 76. It is concluded that the NCRPM recommendations assure adequate protection for the eye of the operator using fluoroscopic equipment. (C.H.)

25250 DOSE-TIME-VOLUME RELATIONSHIP IN SQUAMOUS-CELL CARCINOMA OF THE LARYNX. Gilbert H. Fletcher and Rubin Klein (Univ. of Texas, Houston). Radiology, 82: 1032-41(June 1964).

The survival rates are compared for different radiation techniques, radiotherapeutic management, and surgery in the treatment of squamous-cell carcinoma of the larynx. An analysis is presented of the incidence of persistent or recurrent local disease, severe laryngeal edemas, and necroses in 177 cases of squamous-cell carcinoma of the vocal cords, 10 of in situ carcinoma, and one of squamous papilloma. The clinical material are grouped according to radiatic dose, treatment time, and treatment unit. Clinical factors that might be a common denominator in the recurrence group are discussed. Irradiation techniques are described and radiation dose data are presented with emphasis on dose-time relations. (C.H.)

25251 TIME-DOSE RELATIONSHIPS IN HODGKIN'S DISEASE. R. M. Scott and H. E. Brizel (Univ. of Louisville, Ky.). Radiology, 82: 1043-9(June 1964).

Problems of dose-time relations in the radiation treatment of Hodgkin's disease are reviewed. Experience with both orthovoltage and supervoltage techniques is analyzed. Time-dose curves of the Strandqvist type were constructed for both modalities and compared with those of other workers. The data indicate that supervoltage treatment requires a significantly higher dose for successful therapy than does orthovoltage. For both modalities the dose required for short treatment times is higher than might be expected. (C.H.)

25252 SEQUELAE OF RADICAL RADIOTHERAPY OF CARCINOMA OF THE LUNG. Samuel Hellman, Morton M. Kligerman, Carl F. von Essen, and M. Peter Scibetta (Yale Univ., New Haven and Grace-New Haven Community Hospital, New Haven). Radiology, 82: 1055-61(June 1964).

Survival data are presented for 132 patients with primary carcinoma of the lung treated by x radiation for a total tumor dose of 5000 to 6000 r in 5 to 6 weeks. A second group of 24 patients treated with radical supervoltage radiation therapy followed by thoracotomy in 4 to 8 weeks is considered separately. Emphasis is placed on late complications and sequelae in the patients. It is concluded that aggressive radiotherapy for carcinoma of the lung can be administered without excessive morbidity. The combined radiation and surgical treatment seemed to augment survival. (C.H.)

25253 DOSE DELIVERED TO THE MEDIASTINUM: AN INTERCOMPARISON BETWEEN CENTERS. Ralph Worsnop (Univ. of Texas, Houston). Radiology, 82: 1062-6(June 1964).

Results are presented from a survey at 9 treatment centers of the radiation dose delivered to the mediastinum during preoperative irradiation of lung tumors. A single victoreen rate meter was used at the 9 centers to compare calibration methods and to calculate the tumor dose in a standard phantom and compare local dosimeter readings and calculations with those obtained with the transported meter. Correction factors, measurements, and factors for absorbed dose are discussed. (C.H.)

25254 TELECOBALT THERAPY OF THE LATE PHASES OF MALIGNANT TUMORS. A. I. Mezentsev. Sb. Tr. Sverdlovsk. Gos. Med. Inst., No. 39, 183-7(1963).

Direct results of therapy of malignant tumors of various localization in 187 patients with the aid of GUT-CO-400 apparatus (therapeutic gamma unit) are reported. Recovery (disappearance of the tumor, clinically and roentgenologically) was noted in 35 patients; the decrease of the tumor and the improvement of the clinical condition were noted in 118 patients. No improvement occurred after telecobalt therapy in 34 patients who were in a state of neglect of the

disease and in the presence of distal metastases. It is emphasized that the skin of man is less sensitive to the action of ^{60}Co than to x irradiation. General radiation symptoms in telecobalt radiation are significantly less apparent than those in deep roentgenotherapy. (Referativnyy Zhurnal–Onkologiya, No. 24, Dec. 1963)

25255 STUDIES OF THE SCATTERED RADIATION IN DIAGNOSTIC APPLICATION OF X-RAYS. D. Monstafa. Thesis, Mainz, Universität, 1963. 30p. $2.00(Gmelin, AED-DISS. 63-304). (In German)

The dose of scattered radiation from 60- to 80-kev x rays was measured with condenser ion chambers using a water phantom. Between 2 and 15% of the incident energy are scattered backwards and between 30 and 40% forwards. (Gmelin Inst.)

25256 ERGEBNISSE DER MEDIZINISCHEN STRAHLENFORSCHUNG. NEUE FOLGE. DIAGNOSTIK, THERAPIE, NUKLEARMEDIZIN, BIOLOGIE. BAND I. (Results of Medical Radiation Research. New Series. Diagnostics, Therapy, Nuclear Medicine, and Biology. Volume 1). H. R. Schinz, R. Glauner, and A. Ruettimann, eds. Stuttgart, Georg Thieme Verlag, 1964. 574p. DM 160. Also Available: New York, Intercontinental Medical Book Corp.

The latest knowledge in medical radiation research is summarized in a series of articles written for both the general practitioner and the specialist. The topics reviewed are selective levocardiography, celiacography and angiography of the arteria mesenterica superior, splenoportography, selective renal angiography, venography of the vena cava inferior, lymphography, radioisotopic nephrograms, electron therapy, radiological hypophysis removal, metastatic processes, biochemistry of biological radiation effects, and whole-body counters. (J.S.R.)

25257 BODY SCANNING. Arthur Daniel Rotenberg. Thesis, Toronto, Univ. of Toronto, 1962. 183p.

An investigation was conducted on the understanding, development, and improvement of scanning techniques. The statistics of isotope counting have been extended to cover the problem of distinguishing regions of the body which have different concentrations of isotope. A general expression has been derived for the probability of detecting a "tumor" containing a concentration of isotope different from that of the surrounding medium. Some of the implications of the general expression were explored using idealized geometrical shapes for the "tumor." The parameters of collimator function have been defined and discussed in detail. With the aid of mathematical models and illustrations, a practical approach to collimator design has been developed. The penetration of radiation through collimator septa has a significant effect on both sensitivity and resolution. A program to calculate the sensitivity and resolution of a given collimator was written for the University of Toronto computer (IBM 650), taking into account the penetration of radiation through the shielding material. Four collimator designs have been investigated theoretically by the computer program, and two of the four have also been investigated experimentally. Close agreement between the theoretical and experimental values of sensitivity and resolution has been obtained, especially at photon energies below 1 Mev. The following clinical scanning procedures have been initiated during the period of this investigation: Total body scans using ^{59}Fe for the study of some aspects of erythropoiesis. Total body scans using ^{64}Cu for the study of Wilson's Disease. Total body scans using ^{85}Sr for the study of bone lesions. Chest scans using ^{131}I-RIFA for the study of myocardial infarction. In the course of these and other clinical procedures initiated elsewhere, 905 scans have been performed upon 561 patients using the Body Scanner at The Ontario Cancer Institute. (Dissertation Abstr.)

25258 SCANNING DEVICE FOR RADIATION DIAGNOSIS. Rudolf Prag (to Siemens-Reiniger-Werke AG). German Patent 1,162,002. Jan. 30, 1964. Filed Apr. 8, 1961.

The scanning device described comprises a measuring head with a demountable collimator. The collimator is pressed against the measuring head by springs in such a way that a greater force is to be applied for the detachment of the collimator from the measuring head than to lift the weight of the collimator. By this arrangement it is avoided that the weight of the collimator must be abruptly supported by hand. (Gmelin Inst.)

CHEMISTRY

General

25259 (NYO-10405) A SCINTILLATING ANION EXCHANGE RESIN. Final Report. Alvin H. Heimbuch, Harry Y. Gee, Howard Bould, and Werner J. Schwarz (Tracerlab. Div. of Lab. for Electronics, Inc., Richmond, Calif.). Dec. 1963. Contract AT(30-1)-2885. 66p.

An organic, anion exchange resin containing fluorescent properties was synthesized. The resin was utilized for the detection of radioactive nuclides dissolved in aqueous solutions. Ionic species of alpha and beta emitters were adsorbed from aqueous solution and readily counted by coupling the "activated" resin to a photomultiplier tube and pulse counter. The resin was crosslinked polyvinyltoluene which contained fluorescent compounds dissolved in solid solution, and quaternary ammonium, $-N(CH_3)_3$, groups chemically bound to the polymer. The scintillating resin was prepared by a suspension type polymerization process to yield a spherical bead similar to commercial ion exchange resins. This allowed the resin to be used in conventional type ion exchange columns and, further, to be transferred to a container of any geometric shape for maximum light collection. Simple, optically clear, plastic cups were used in one method for counting the activated resin by coupling the container to a photomultiplier tube connected to a pulse counter. In a second method, glass vials were used for counting the activated resin in a liquid scintillation counter. Alpha and beta activated resins were counted in aqueous and organic liquids. Higher counting efficiencies were obtained in toluene than in water, since the refractive index to toluene more closely matches that of the resin. The use of a liquid scintillation counter gave higher counting efficiencies since the photomultiplier tubes can be operated at refrigeration temperatures. Counting efficiencies of 70% or better were obtained for alpha emitters of ^{237}Np and ^{239}Pu adsorbed as complex chloride anions on the resin. Beta emitters were counted with per cent efficiencies as follows: ^{14}C, 35; ^{35}S, 39; ^{36}Cl, 85; and ^{131}I, 74. Detection of ^{131}I in milk and ^{14}C tagged amino acids are illustrated as applications of the resin. (auth)

25260 FORMATION CONSTANTS OF SOME RARE-EARTH COMPLEXES. William Ray Stagg. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 103p.

The stepwise formation constants for complexes between the trivalent metals lanthanum, yttrium, and all of the rare earths, except promethium, and the ligands isobutyrate (IBU), α-hydroxyisobutyrate (AHIB) and α,β,β'-trihydroxyisobutyrate (THIB) were measured at 25°C and an ionic strength of 0.5 M ($NaClO_4$). For lanthanum and the first half of the rare-earth series, the magnitude of the formation constants increased in the order IBU, AHIB, THIB. For the remainder of the series and yttrium, the magnitude increased in the order IBU, THIB, AHIB. It was postulated that the inversion of the AHIB and THIB stabilities with increasing atomic number was brought about by a change in the number of coordination sites of the metal which could be occupied by the THIB ligand. The IBU and THIB complex formation constants both exhibit a sinusoidal behavior when plotted as a function of atomic number. Such a plot for the AHIB complexes increases more or less uniformly. Because of this, it was concluded that the AHIB would be the superior ligand to use as an eluant for ion-exchange chromatographic separation of rare-earth mixtures. (Dissertation Abstr.)

25261 KINETICS OF DEUTERIUM ABSTRACTION AS A FUNCTION OF BOND ENERGY. Halbert Hart Carmichael. Thesis, Berkeley, Calif., Univ. of California, 1963. 92p.

The abstraction of H or D atoms by trifluoromethyl radicals from CH_4, CD_4, CCl_3H, CCl_3D, and $(CH_3)_3CD$ was studied by photylyzing hexafluoroacetone in the presence of the substrate. The activation energies were found to be 11.0 ± 0.1, 12.1 ± 2.1, 9.0 ± 0.4, 6.3 ± 0.6, and 7.4 ± 1.0 kcal/mole, respectively. The method of London, Eyring, Polanyi, and Sato, and the method of Johnston were used to predict the properties of the activated complexes for 14 abstraction reactions of trifluoromethyl radicals with the compounds $CH\ X_{4-n}$ where the X's are chlorine atoms or methyl groups. The observable kinetic parameters were then calculated from the predicted activated complex properties, taking into consideration quantum mechanical tunnelling. The two theoretical methods do not differ markedly in their predictions of observable quantities. The calculated activation energies decreased with increasing exothermicity of the reactions as did the calculated kinetic isotope effects. The experimental observation is that both the activation energies and kinetic isotope effects decrease with increasing exothermicity but do so somewhat more rapidly than is predicted by the theoretical methods. (Dissertation Abstr., 24: No. 8, Feb. (1964))

25262 IMPROVEMENTS IN OR RELATING TO ION EXCHANGERS. Pierre Cohen and Rene Amavis (to Commissariat a l'Energie Atomique). British Patent 959,574. June 3, 1964. Priority date Nov. 16, 1959, France.

Basic lead sulfates have ion exchange properties and can be utilized as anion exchangers in acid solution and as cation exchangers in basic solution. They also have exceptional stability to radiations and temperature. The basic lead sulfates that have these properties correspond to the formula $PbSO_4 \cdot nPbO \cdot n'H_2O$, where n, n' integers, or mixtures of such sulfates. They can be used in the separation of rare earths and in the decontamination of radioactive liquors, and examples of these uses are given. (D.L.C.)

Analytical Procedures

25263 (AWRE/Lib/Bib/8) ANALYSIS OF URANIUM FOR TRACE IMPURITIES (<100 p.p.m.). Dorothy Beck (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). May 1964. 19p.

One hundred and seventy-four references, with brief abstracts, are given for methods of determining more than 35 elements, in trace amounts, in uranium metal. (M.C.G.)

25264 (CNLM-4016) INSTRUMENTATION FOR DETERMINING ARGON AND HELIUM PURITY. E. A. Limoncelli and J. A. Stern (Pratt and Whitney Aircraft Div., United Aircraft Corp. Connecticut Aircraft Nuclear Engine Lab., Middletown). Mar. 15, 1962. Contract AT (30-1)-2789. 5p.

The instruments available for determining water, oxygen, and other impurities in argon and helium are described,

and details are given of their operation and performance. The instruments include the dew pointer, electrolytic hygrometer, cupric ion system, coulometric electrode system, and chromatograph. (D.L.C.)

25265 (HASL-143) DETERMINATION OF CERIUM-144 IN VEGETATION AND SOIL. Doris C. Sutton (New York Operations Office. Health and Safety Lab., AEC). Feb. 1964. 41p.

An extraction method was used to determine ^{144}Ce in vegetation and soil. The principle advantages of the method are equilibration of Ce carrier and activity in the initial step of the procedure, and provision for the determination of ^{90}Sr and ^{137}Cs in vegetation and ^{89}Sr and normal Ce in soil. The results of measurements on 14 wheat samples collected from sites in the United States during 1962 are reported. Data for replicate analyses of two soil types and duplicate and single analyses for a small varied group of soils collected in 1960 are listed. (auth)

25266 (HW-28529) THE SPECTROPHOTOMETRIC DETERMINATION OF BORON IN PLUTONIUM USING AN OXALATE. Donald M. Newell (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 25, 1953. Contract W-31-109-eng-52. 12p.

A method for the determination of boron in plutonium is reported. Precipitation of plutonium(III) acid oxalate prior to color development with curcumin resulted in increased precision, greater speed, and lower costs. Results of a statistical study involving all variables are presented. (auth)

25267 (K-1521) DETERMINATION OF STRONTIUM-90 IN DRINKING WATER. G. S. Petit and C. A. Kienberger (Oak Ridge Gaseous Diffusion Plant, Tenn.). June 8, 1964. Contract W-7405-eng-26. 13p.

A method is described for the determination of ^{90}Sr in raw and sanitary water at concentrations lower than 10 $\mu\mu C/l$, the maximum permissible limit recently prescribed by the U. S. Public Health Service. A known amount of natural strontium is added to the sample as a carrier. ^{90}Y, daughter of ^{90}Sr, is removed by scavenging with iron in a basic solution. The strontium is separated from impurities by a triple precipitation, first as the oxalate, then as the nitrate in concentrated nitric acid, and again as the oxalate which is dried, weighed, and counted. The activity of the recovered ^{90}Sr is determined from either an absorption curve or from the growth and decay curves of ^{90}Y and ^{89}Sr, respectively. (auth)

25268 (ML-TDR-64-36) A PLASMA ARC TECHNIQUE FOR THE SPECTROCHEMICAL DETERMINATION OF TITANIUM AND ZIRCONIUM IN MOLYBDENUM. James H. Muntz (Research and Technology Div. Air Force Materials Lab., Wright-Patterson AFB, Ohio). Jan. 1964. 12p.

A plasma arc technique was developed for the spectrochemical determination of titanium and zirconium in molybdenum alloys. Titanium was determined in the 0.25 to 1.5% range and zirconium in the 0.05 to 0.4% range with an overall precision of about ±5% and an accuracy that approached the precision. Sensitivity for the zirconium determination was achieved by using high gas flow and high amperage. Molybdenum was used as the internal standard and a background correction was necessary to produce a straight line analytical curve for zirconium over the concentration range of interest. (auth)

25269 (NLCO-905) SUMMARY TECHNICAL REPORT FOR THE PERIOD JANUARY 1, 1964 TO MARCH 31, 1964. R. Burgett, ed. (National Lead Co. of Ohio, Cincinnati). Apr. 28, 1964. Contract AT(30-1)-1156. 76p.

An Automatic system was developed in which 12 mass spectrometer sample valves may be cleaned simultaneously in 10 minutes. The relationship between confidence interval limits and expected value of preferred orientation was investigated. A Ni–Fe–Cr heat-resistant alloy was analyzed in the electron microprobe, and its chemical composition was determined. Uranium shot containing small additions of zirconium and carbon in various combinations was studied in the microprobe, and the phases present were identified. The optical measurement of the reflectance of uranium was found to be a promising method for the determination of grain size. Uranium billet temperatures and carbon, iron, and silicon concentrations were evaluated to determine their effects on the recrystallization of rolled rods and on the grain size of beta heat-treated fuel cores. Mark VB outer fuel cores were heated by induction and quenched in oil. Grain structures were finer than those in salt-heated, oil-quenched cores, and just as uniform from core to core. A nondestructive inspection system was developed for production use to identify uranium fuel cores of different ^{235}U contents by means of their gamma-ray emissions. Tests demonstrated the feasibility of dissolving aluminum–uranium alloys in a nitric acid–mercuric nitrate solution. The acidic product is used to digest uranium residues high in fluorides. An ion plasma reactor was designed and installed to investigate the reduction of uranium oxides by thermal dissociation. (auth)

25270 (NYO-10726) NON-DESTRUCTIVE MEASUREMENT OF U-235 RETAINED IN ABSOLUTE AIR FILTERS. Ira Cohen and Alan M. Fishman (New York Operations Office, AEC). Apr. 15, 1964. 15p.

A rapid non-destructive method is described for the determination of ^{235}U contained in absolute air filters utilizing gamma spectrometry. The procedure consists of scanning approximately 50 per cent of the surface area of an unknown filter at the 184 kev photopeak and comparing the counts obtained to a similar scan of a prepared known filter. Each filter was also analyzed for ^{235}U by destructive analysis. A student "t" test on paired data indicated no significant difference between the two methods. The relative error was 10 per cent. This method can be used to determine if contaminated filters should be discarded or reclaimed. (auth)

25271 (TID-7015(Indexes)(Rev.1)) INDEXES TO THE OAK RIDGE NATIONAL LABORATORY MASTER ANALYTICAL MANUAL, 1953–1963. Helen P. Raaen and Ann S. Klein, eds. (Oak Ridge National Lab., Tenn.). 142p.

The indexes consist of a key word index, a bibliographic index giving the history and current status of each method, an author index, and method-number cross indexes. (D.L.C.)

25272 (VDDIT-90) DETERMINATION OF TRACE AMOUNTS OF Cd, Cr, Co, Fe, Mn AND Mo IN METALLIC URANIUM AND URANIUM COMPOUNDS. A Literaure Survey. Hans I. Holm (Aktiebolaget Atomenergi, Stockholm). Apr. 1964. 43p.

One hundred and fourteen abstracts on the determination of trace amounts of Cd, Cr, Co, Fe, Mn, and Mo in metallic uranium and uranium compounds are presented. The abstracts were obtained from Analytical Abstracts, Chemical Abstracts, and Nuclear Science Abstracts covering the period 1954 to 1963. (M.C.G.)

25273 (AEC-tr-6227/1(p.9-14)) DETERMINATION OF CO_2, H_2 AND O_2 IN AQUEOUS SOLUTIONS BY GAS CHROMATOGRAPHY. Lj. V. Petković, M. M. Kosanić, and I. G Draganić. Translated from Bull. Boris Kidrich Inst. Nucl Sci., 15: No. 1, 9-14(1964).

A procedure is described for extraction and determination of H_2, O_2, and CO_2 by gas chromatography. A combination of a Toepler gauge and a commercial vapor fractometer was used. The components were separated on a silica gel column with argon or helium as the carrier gas. The procedure can be used for the determination of small amounts of gases (1 to 200 mm^3) with an accuracy better than 5%. (auth)

25274 SELECTIVE LIQUID-LIQUID EXTRACTION ON RADIOTIN WITH 2-THENOYLTRIFLUOROACETONE. James R. Stokeley and Fletcher L. Moore (Oak Ridge National Lab., Tenn.). Anal. Chem., 36: 1203-6(June 1964).

A new, rapid, highly selective liquid-liquid extraction method for radiotin is based on the extraction of radiotin from a sulfuric acid–chloride aqueous medium with 0.5M 2-thenoyltrifluoroacetone–methyl isobutyl ketone. Tartaric acid or sulfuric acid readily strips the tin from the organic phase. The method was employed successfully in the radiochemical purification and isolation of radiotin from both old and new fission product mixtures. A redetermination of the half life and gamma spectral characteristics of ^{128}Sn is reported. (auth)

25275 A PORTABLE FLUORESCENT X-RAY INSTRUMENT UTILIZING RADIOISOTOPE SOURCES. J. O. Karttunen, H. B. Evans, D. J. Henderson, P. J. Markovich, and R. L. Niemann (Argonne National Lab., Ill.). Anal. Chem., 36: 1277-82(June 1964).

Tritium absorbed in Zr furnishes an excellent excitation source for the generation of fluorescent x rays in elements requiring 3 to 12 kev. The bremsstrahlung radiation from this radioactive source is used to excite the characteristic fluorescent x rays of elements in the range Z = 16 to 35. The quantitative analysis of binary, ternary, and quaternary mixtures is illustrated. The apparatus is miniaturized and can be contained in a volume of less than 1 ft^3. (auth)

25276 DISSOLUTION AND ASSAY OF ELEMENTAL BORON. A. R. Eberle, L. J. Pinto, and M. W. Lerner (Atomic Energy Commission, New Brunswick, N. J.). Anal. Chem., 36: 1282-5(June 1964).

Two new methods for the assay of elemental B are presented. In one, the B is dissolved by a K persulfate fusion carried out in quartz. The technique has certain advantages over the usual sodium carbonate–Pt crucible fusion. The boric acid obtained is determined by the conventional mannitol titration procedure. The other method involves a pyrohydrolytic separation of the B. Substantially a pure boric acid is obtained that can be determined by titration in the presence of mannitol to a single end point. Both methods appear to be accurate and precise. (auth)

25277 SEPARATION AND DETERMINATION OF ZIRCONIUM IN ZIRCONIA-YTTRIA MIXTURES BY PRECIPITATION WITH CUPFERRON. E. June Maienthal and John K. Taylor (National Bureau of Standards, Washington, D. C.). Anal. Chem., 36: 1286-7(June 1964).

A method is described for the determination of Zr in zirconia–yttria mixtures. The method is simple, accurate, and applicable to concentrations of zirconia ranging from 4 to 97%. For 11 determinations within this range, the mean error was 0.05%; the maximum, 0.15%. Previous literature indicates that precipitation with cupferron yields a zirconia precipitate contaminated with yttria, but quantitative separation is achieved by a double cupferron precipitation. (auth)

25278 THE PREMIXED, FUEL-RICH, OXYACETYLENE FLAME IN FLAME EMISSION SPECTROMETRY. A. P. D'Silva, R. N. Kniseley, and V. A. Fassel (Ames Lab., Ames, Iowa). Anal. Chem., 36: 1287-9(June 1964). (IS-834)

An improved premixed, oxyacetylene burner, which can be safely operated under fuel-rich conditions, is described. Observation of the atomic line spectra emitted in the interconal zone of this flame has made it possible to detect, for the first time, analytically useful lines for Ce, Hf, Ta, Th, U, and Zr in a simple flame. Sensitivities of detection for the strongest lines of 26 elements, whose lines are not emitted with significant intensity in stoichiometric hydrogen or hydrocarbon-fuel flames, are tabulated. (auth)

25279 AMINE EXTRACTION-SPECTROGRAPHIC DETERMINATION OF TANTALUM IN PLUTONIUM. Roy Ko (General Electric Co., Richland, Wash.). Anal. Chem., 36: 1290-1(June 1964).

An emission spectrographic method for the determination of μg amounts of Ta in Pu is described. The Pu is dissolved in hydrochloric acid and extracted into tri-n-octylamine (TNOA) before Ta dissolution is even tried. Once the Pu is removed, hydrofluoric acid is added to dissolve the Ta and the aqueous phase analyzed spectrographically for Ta using Nb as the internal standard. Concentrations of Ta as low as 20 ppm in 100 mg of Pu can be determined. (auth)

25280 SEPARATION OF MOLYBDENUM IN STEELS BY REVERSED-PHASE CHROMATOGRAPHY. James S. Fritz and C. E. Hedrick (Ames Lab., Ames, Iowa). Anal. Chem., 36: 1324-6(June 1964). (IS-820)

Molybdenum(VI) is retained by a column packed with Kel-F 300 low density molding powder impregnated with methyl isobutyl ketone and separated from several other metal ions by elution with 1 to 1 hydrochloric acid containing 1M sulfuric acid. Molybdenum(VI) is eluted from the column with 1 to 1 hydrochloric acid, and Fe(III) is then stripped from the column with dilute sulfuric acid. Small amounts of W(VI) can be separated from Mo(VI) by elution with a 1 to 1 hydrochloric acid eluent that is 1M in sulfuric acid and 0.1M in hydrofluoric acid. (auth)

25281 SPECTROPHOTOMETRIC DETERMINATION OF TRACE AMOUNTS OF ZIRCONIUM, TITANIUM, AND MOLYBDENUM IN TUNGSTEN USING ANION EXCHANGE SEPARATIONS. Ken F. Sugawara (Air Force Materials Lab. (MAYA), Wright-Patterson AFB, Ohio). Anal. Chem., 36: 1374-5(June 1964).

A method is described for the spectrophotometric determination of traces of Zr, Mo, and Ti in W using anion exchange separations. Zr is separated from Ti through a liquid-liquid extraction step. The Zr accompanies Ti quantitatively through the ion exchange column if a sufficient volume of 8M HCl is used. Mo was eluted with 5% HF–25% HCl. However, it is believed that the Mo results might have been improved somewhat by the use of 20% HF–25% HCl. (P.C.H.)

25282 DETERMINATION OF NICKEL IN HYDROGENATED FATS BY NEUTRON ACTIVATION ANALYSIS. A. G. Souliotis (Nuclear Research Center "Democritus," Athens). Anal. Chem., 36: 1385-6(June 1964).

Nickel was determined by neutron activation analysis in fats of various origins, hydrogenated and nonhydrogenated. Simple irradiation techniques and selective radiochemical separations were used. Primary extractions and isolations of Ni result in the elimination of the hydrolysis method. Experimental values are reproducible within a relative error less than ±2%. The sensitivity of the method reaches the value of 10^{-4} ppm if a high neutron flux is used. (P.C.H.)

25283 SEPARATION AND DETERMINATION OF URANIUM IN HIGH ZIRCONIUM ALLOYS. R. F. Rolf (Dow Chemical Co., Midland, Mich.). Anal. Chem., 36: 1398-1400(June 1964).

Bromomandelic acid was used to separate fission-product Zr plus carrier Zr from an Al–Mg matrix. The zirconium bromomandelate precipitate carries approximately 11% of the ^{95}Nb and less than 1% of fission product Sr, Y, Ru, or Ce. A study of the coprecipitation of U by the bromomandelate precipitate was made to evaluate the possibility of a direct determination of U in the filtrate. The results show that U(VI) is not coprecipitated by Zr bromomandelate. However, the presence of bromomandelic acid in the filtrate has no effect on the fluorometric determination of U. (P.C.H.)

25284 SPECTROPHOTOMETRIC METHOD FOR DETERMINATION OF NIOBIUM IN TANTALUM AND TANTALUM OXIDE. Koichi Nishimura and Hiroshi Irokawa (Sumitomo Metal Mining Co., Tokyo). Bunseki Kagaku, 13: 304-9(Apr. 1964). (In Japanese)

The separation of Ta by the adsorption on anion-exchange resin and the determination of Nb by the ethyl ether extraction of its thiocyanate complex were investigated. Ta metal and Ta oxide were decomposed respectively by $HF-HNO_3$ and $NH_4HF_2-HNO_3$ and its 3M HCl–0.1M HF solution was passed through an anion-exchange resin. The absorption of Ta reached saturation at 1.25 g Ta/5 ml. Prepared resin and 125 ml of the effluent contained the whole Nb. Conditions for coloration and extraction of Nb, especially the necessary amounts of reagents, were determined as follows: 10 ml of 20% tartaric acid, 15 ml of 4% boric acid, 15 ml of HCl, 10 ml of 20% $SnCl_2$, 8 ml of 50% NH_4CNS and the total volume of solution about 80 ml. Ethyl ether got turbid by the water, and 10% acetone was added to remove the turbidity. The lower limit of determination by this method was 10 ppm and the standard deviation was ca 1 ppm. (auth)

25285 SPECTROPHOTOMETRIC DETERMINATION OF RARE EARTH ELEMENTS WITH XYLENOL ORANGE. Kiyoko Takahashi (National Research Inst. for Metals, Tokyo). Bunseki Kagaku, 13: 343-6(Apr. 1964). (In Japanese)

Photometric methods for the analysis of Pr, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu are described. Xylenol Orange reacts with each rare earth element and forms a stable red-violet complex at about pH 6. Various factors affecting the color products were studied. In the concentration range $0 \sim 80$ μg R. E./25 ml, the calibration curves obey Beer's law. Results of the continuous variation method and the mole ratio method indicate that Xylenol Orange forms a 1:1 metal-reagent complex at pH 6.10. The molar extinction coefficient at 578 mμ was calculated for each complex. (auth)

25286 DETERMINATION OF MICROTRACE CONTENT OF COPPER, ZINC, AND ARSENIC IN NITRIC AND HYDROCHLORIC ACIDS BY THE NEUTRON ACTIVATION ANALYSIS. Zygmunt Allina and Wieslaw Otwinowski (Inst. of General Chemistry, Warsaw). Chem. Anal. (Warsaw), 9: 205-11(1964). (In Polish)

A neutron activation method for determining microtrace amounts of copper, zinc, and arsenic in nitric and hydrochloric acids is described. The dry residue of 10 ml of acid was irradiated during 20 hours in a nuclear reactor with a beam of 10^{13} neutrons per sec per cm^2. The elements determined were isolated and radiochemically purified, and the activity of β radiation of ^{64}Cu, ^{69m}Zn, and ^{76}As isotopes was measured. The lower limit of determination for Cu, Zn, and As was estimated respectively as: 10^{-10}, 10^{-8}, and 5.10^{-11} g/ml. The coefficient of variation of the average result (based on three independent determinations) did not exceed 30%. (auth)

25287 SODIUM MOLYBDATE AS A REAGENT IN VOLUMETRIC ANALYSIS. I. TITROMETRIC DETERMINATION OF TRIVALENT CERIUM IONS. Alina Bukowska and Wiktor Wawrzyczek (School of Agriculture, Olsztyn, Poland). Chem. Anal. (Warsaw), 9: 249-53(1964). (In Polish)

An accurate and rapid method of determining trivalent Ce ions in pure salts was elaborated. A titrant sodium molybdate was used in the presence of methyl red and bromocresol green as adsorption indicators. In titration of Ce^{3+} for every 5 ml of solution two drops of methyl red and bromocresol green solutions were added. Under the influence of indicators the Ce^{3+} solution turns violet-red. The $Ce_2(MoO_4)_3$ precipitate at the neutral point has a sea-green color and the liquid above the precipitate turns green. The error of determination in the range of Ce^{3+} concentrations examined did not exceed 0.5%. The method can be used for determining Ce^{3+} in pure salts only, as heavy metals and remaining rare earth metals give also sparingly-soluble salts with sodium molybdate. (auth)

25288 SPECTROGRAPHIC DETERMINATION OF LANTHANUM, NEODYMIUM, AND PRASEODYMIUM IN HIGH PURITY COMPOUNDS. Zofia Radwan and Bozena Strzyzewska (Inst. of Nuclear Research, Warsaw). Chem. Anal. (Warsaw), 9: 297-302(1964). (In Polish)

A method was developed for direct determination of lanthanum, neodymium, and praseodymium in compounds. A compound converted to the oxide form was mixed with graphite powder in a ratio 1:1 and excited in the d-c arc of 6 amp current strength in the carbon electrode with a crater in an atmosphere of 20% argon and 80% oxygen. A spectrograph and camera were employed. The method covered a region of 0.02 to 1% for lanthanum and neodymium and 0.05 to 1% for praseodymium. The coefficient of variation for the individual determinations amounted on the average to ±7%. The method allows quick control of a high-purity preparation during its purification. (tr-auth)

25289 THE ISOLATION OF CARBIDE PHASE FROM Ti–W ALLOYED Cr–Ni STEEL AND ITS ANALYSIS VIA ACTIVATION METHOD. Oldřich Opravil, Bohumil Žitňanský, and Imrich Šebestian (Research Inst. of Welding, Bratislava). Chem. Listy, 57: 1294-1300(1963). (In Czech.).

The isolation and analysis of the carbide phase from the austenitic steel 1 Cr–16 Ni–13 W–Ti are described. An electrolytic method was used for isolation of the carbide phase from cylindrical samples with controlled cooling and introduction of an inert gas. The problem of determination of W and Ti in the isolated phase was solved by spectrometric activation analysis. The method was found to be very sensitive, especially with regard to the tungsten content. Its accuracy was higher than colorimetric methods. (tr-auth)

25290 NUCLEAR RADIATION USED IN THE ANALYSIS OF GASES AND VAPORS. Hans-Karl Bothe and Peter Adler (Institut für Angewandte Radioaktivität, Leipzig). Chem. Tech. (Leipzig), 16: 169-74(Mar. 1964). (In German)

The physical principles, extension possibilities, and technical assumptions for analyses of gases and vapors with the help of nuclear radiation are discussed. The ionization-

analysis method is not suitable for the complete analysis of complex gas mixtures, nevertheless its slight disturbance susceptibility opens favorable possibilities for continuous control and regulation of the processes. It is especially suited for the detection of traces of electronegative gases such as O_2, H_2O, or halogens, in inert gases. (tr-auth)

25291 THE ANALYSIS OF PLUTONIUM. F. Regnaud. Chim. Anal. (Paris), 46: 133-7(Mar. 1964). (In French)

Because of its very varied properties, Pu can be determined by a number of methods: chemical, instrumental, and physical. The application of these methods is, however, complicated by the need for so many precautions. A brief description of the installations used gives an idea of the technological difficulties surrounding the performance of the analyses, the selection of the method, and the cost price. After an indication of the present state of Pu analysis, an example is given to illustrate the nature of the analyses demanded, the complexity of the problems, and the solutions used. (tr-auth)

25292 QUINIZARINE SULFONIC ACID (1,4-DIHYDROXYL ANTHRAQUINONE SULFONIC-3 ACID) AS CHELATOCHROME INDICATOR FOR THE COMPLEXOMETRIC DETERMINATION OF THORIUM. Satendra P. Sangal (Univ. of Allahabad, India). Chim. Anal. (Paris), 46: 138-40(Mar. 1964). (In French)

Quinizarine sulfonic acid acts as a satisfactory chelatochrome indicator in the titration of Th^{4+} with EDTA. Two drops of the solution is enough to titrate thorium chloride or EDTA in dilute solutions up to 0.001 M. Reverse titrations are possible between pH 1.5 and 3.5 at all temperatures. The presence of Cu^{2+}, Be^{2+}, Mg^{2+}, Al^{3+}, Sn^{2+}, Sn^{4+}, Pb^{2+}, V^{5+}, As^{3+}, Sb^{3+}, Bi^{3+}, Ti^{4+}, Zr^{4+}, Cr^{6+}, Mo^{6+}, W^{6+}, Mn^{2+}, Fe^{2+}, Fe^{3+}, Co^{2+}, Ni^{2+}, tartrate, fluoride, acetate, and borate cause interferences in the titrations. (tr-auth)

25293 ^{14}C RADIOACTIVE MEASUREMENTS OF ORGANIC SUBSTANCES INSOLUBLE IN THE SCINTILLATOR BY LIQUID SCINTILLATION OR IN INNER GAS COUNTER TUBES. R. Tykva (Czechoslovak Academy of Sciences, Prague). Collection Czech. Chem. Commun., 29: 680-9 (Mar. 1964). (In German)

A method is described, which makes possible, in a simple apparatus, obtaining carbon dioxide from samples of organic substances and in the course of the continuous oxidation directs introduction, without unwanted impurities, into either an internal gas counter tube or in hyamine hydroxide and then in a liquid scintillator. The method, with the apparatus used, served for measurement of the relative activities of samples, which contained as little as 40 mg total carbon. Within 8 hr more than 80 samples can be prepared for the scintillator or 34 to 40 gas counter tubes filled by one worker. The character of the sample is essentially without influence. The construction of a simple internal gas counter tube is described. (tr-auth)

25294 ION EXCHANGE PROCEDURES. II. SEPARATION OF ZIRCONIUM, NEPTUNIUM AND NIOBIUM. James H. Holloway and Frederick Nelson (Oak Ridge National Lab., Tenn.). J. Chromatog., 14: 255-7(Apr. 1964).

An anion exchange procedure for separating trace amounts of neptunium and niobium from each other and from macro-amounts of zirconium is described. The method makes use of the fact that Zr(IV) in HCl–HF media at high HCl concentrations is essentially non-adsorbable by anion exchange resins under conditions where Np(VI) and Nb(V) are strongly adsorbed. (P.C.H.)

25295 ION EXCHANGE PROCEDURES. III. SEPARATION OF URANIUM, NEPTUNIUM AND PLUTONIUM. Frederick Nelson, Donna C. Michelson, and James H. Holloway (Oak Ridge National Lab., Tenn.). J. Chromatog., 14: 258-60(Apr. 1964).

An anion exchange procedure is described for separating uranium, neptunium, and plutonium from each other and from several non-adsorbed elements. While removal of Np as Np(IV) could be carried out with 4M HCl, HCl–HF mixtures were used because they give sharper bands and more rapid removal. Column operation time for the separation of U, Np, Pu, and non-adsorbed elements into individual fractions is about 80 min. (P.C.H.)

25296 A METHOD FOR THE DETERMINATION OF FREE I^{131} IN RADIOIODINATED LIPIDS. A. G. Cox and Zena Hinchliffe (Royal Infirmary, Sheffield, Eng.). J. Clin. Pathol., 15: 76-81(Jan. 1962).

A new method is introduced for estimating the free ^{131}I content of ^{131}I-labeled lipids, such as triolein and oleic acid, used in intestinal absorption studies. These studies require that the administered fat should not contain free ^{131}I. This simple method employs an anion exchange resin (Amberlite IRA-400, Cl form). For determining the amount of free radioactivity in emulsions of triolein labeled with ^{131}I in the form of ^{131}ICl, no special modifications are necessary. With radioiodinated oleic acid, the working solution is made up with an excess of unlabeled oleic acid emulsion to prevent uptake of bound radioactivity by the resin. Recovery experiments show the method to be about 90% efficient, which is adequate when the radiolipids are to be used for clinical purposes. The radiolipids were used as emulsions prepared by shaking the labeled oil with water and Tween 80 in a stoppered tube. In this way it was possible to minimize the radiation hazards inherent in the repeated handling of radioactive materials dissolved in volatile fat solvents. The described technique is particularly useful for ensuring the purity of ^{131}I-lipids prepared in the clinical laboratory. Commercially labeled radiolipids are expensive, and a tagging procedure is available which can be performed quickly and at negligible cost. To make certain that batches of radioiodinated triolein and oleic acid labeled locally do not contain significant amounts of unbound radioactivity, chromatography, dialysis, and the separation of bound activity by ether extraction are relatively cumbersome procedures and not recommended for routine use. However, anion-exchange resin provides a rapid and effective procedure. The chemistry of ^{131}ICl is discussed in relation to its use for labeling biological materials and subsequent removal of excess reagent. (BBB)

25297 THE DETERMINATION OF CHLORIDE ACTIVITY IN AN ANION EXCHANGE RESIN (AMBERLITE IRA-410), FROM THE STUDY OF THE DISTRIBUTION COEFFICIENTS OF STABLE ANIONS. R. Barbieri (Universita, Padua). J. Inorg. Nucl. Chem., 26: 845-53(May 1964).

The invasion correction function ${}_rF_a$, for the system LiCl aq–Amberlite IRA-410, was determined. This was carried out by measurements of the distribution coefficients of the stable anions Br^- and $Zn(CN)_4^{2-}$ at various LiCl concentrations. The ${}_rF_a$ function obtained in such a way was found to be correct by comparing with direct measurements of the invasion. The use of this accurate and simple method will noticeably expedite the determination of ${}_rF_a$. (P.C.H.)

25298 SEPARATION AND GAMMA SPECTROMETRIC DETERMINATION OF CARRIER-FREE SCANDIUM ISO-

TOPES FROM PILE-IRRADIATED TiO_2 TARGETS. A. A. Abdel-Rassoul, H. Fouad, and Salah Mohammed (U.A.R. Atomic Energy Establishment, Inchass, Egypt). J. Inorg. Nucl. Chem., 26: 890-2(May 1964).

An investigation was made on the possibility of determining the ^{48}Sc to ^{46}Sc ratio in irradiated Ti samples of natural isotopic composition by gamma spectrometry as an aid to determination of the isotopic abundance of some Ti isotopes by this technique. It also provides a check on the published relative cross section data for the neutron-induced nuclear reactions producing the Sc isotopes from irradiated Ti targets. It was concluded that gamma spectrometry can be used to determine the ratio of the radioisotopes with a deviation not exceeding 5%. The measurements also confirmed the relative cross sections previously reported for the reactions producing ^{48}Sc and ^{46}Sc within certain limits. (P.C.H.)

25299 QUANTITATIVE DETERMINATION OF PLUTONIUM IN URINE. J. Sommer (Zentralinstitut fur Kernforschung, Rossendorf, Ger.). Kernenergie, 7: 257-63(Apr. 1964). (In German)

Two methods are described for the quantitative determination of ^{239}Pu in urine. The alkaline earth-phosphate precipitation for separation of ^{239}Pu from urine was carried out with both the cupferron and TTA extraction methods. The effectiveness of the cupferron extraction method amounted to 63% with a standard deviation of ±15%. The effectiveness of the TTA extraction method was 85% and the standard deviation was ±9%. This last method is recommended for monitoring persons for whom the possibility of ^{239}Pu incorporation exists because of its low zero level. (tr-auth)

25300 DETERMINATION OF COPPER IN GALLIUM ARSENIDE BY ACTIVATION ANALYSIS. S. Niese (Zentralinstitut fur Kernforschung, Rossendorf, Ger.). Kernenergie, 7: 263(Apr. 1964). (In German)

It was found that in the determination of copper in gallium and gallium compounds by activation analysis, the formation of ^{67}Cu from gallium occurs. The effective cross section for the $^{71}Ga(n,\alpha n)^{67}Cu$ reaction was determined in the Rossendorf Reactor WWR-S; it amounted to 0.22 μb. (tr-auth)

25301 MEASUREMENT OF ISOTOPES EMITTING SOFT BETA RADIATION WITH THE AID OF A LIQUID SCINTILLATOR IN A SINGLE-CHANNEL MEASURING INSTRUMENT. PART 2. DETERMINATION OF TRITIUM IN THE FORM OF WATER AND HYDROCARBON. Piroska Csanyi, Bela Levay, and Andras Salamon. Magy. Kem. Folyoirat, 70: No. 4, 184-9(Apr. 1964).

A modified EKCO N 664 A single-channel liquid-scintillator instrument was used at +10°C, at a 1000-times amplification, at an operating voltage of 1600 v, and at a discriminator voltage of 5 v. A Chance OX 7 optical glass filter was used to filter out any phosphorescence. Minimum activity that was detectable was 1.4×10^{-6} μC/ml. (OTS)

25302 RADIOCHEMICAL INVESTIGATION OF COMBUSTION METHOD FOR DETERMINATION OF SULPHUR BY ^{35}S. Tadashi Endo. Nippon Kokan Giho, 26: 238-46 (May 1963). (In Japanese)

As a result of radiochemical investigation of the combustion method for the determination of sulfur contained in raw materials (pig iron, heavy oil, and coal) used in the iron and steel industry, it was confirmed that sulfur was lost through remaining in residues, sticking to the cap, and the combustion tube of analyzing apparatus and running away from the apparatus. The loss was caused mainly by sticking of SO_3, which generated from the reaction $SO_2 + O_2 \rightleftharpoons SO_3$, to the cap and the combustion tube. The quantity of sulfur stuck to the cap amounted to a maximum of 20%, while the loss of sulfur from H_2O_2 absorbing solution was only about 0.3% of the total sulfur. (auth)

25303 ELECTRON SPECTROSCOPY FOR CHEMICAL ANALYSES. S. Hagstroem, C. Nordling, and K. Siegbahn (Uppsala Univ.). Phys. Letters, 9: 235-6(Apr. 15, 1964).

The use of electron spectroscopy for qualitative and quantitative chemical analysis, by determination of relative positions and intensities of photoelectric lines, is described. Results for SiC are given. Electron spectroscopy for determination of the chemical valence states from studies of the perturbations of inner energy levels is discussed. Results for sulfur valences in neutral sulfur, sodium sulfite, sodium thiosulfate, and sodium sulfate are presented. (M.J.T.)

25304 A NEUTRON ACTIVATION TECHNIQUE FOR OXYGEN DETERMINATION. A. Metcalf. Steel Times, 188: 90-2(Jan. 17, 1964).

Steel, containing oxygen, is neutron-irradiated, producing radioactive oxygen. The oxygen decay, which is 94% completed in 30 sec, emits gamma rays that are measured and interpreted to determine the oxygen content. (Rev. Metal Lit., 21: No. 4, April 1964)

25305 ION EXCHANGE IN NON-AQUEOUS SOLVENTS. ADSORPTION BEHAVIOUR OF URANIUM AND OTHER ELEMENTS ON STRONG-BASE ANION-EXCHANGE RESIN FROM ORGANIC ACID-ORGANIC SOLVENT MEDIA. METHODS FOR THE SEPARATION OF URANIUM. J. Korkisch and S. Urubay (Universität, Vienna). Talanta, 11: 721-46(May 1964).

The anion-exchange behavior of hexavalent uranium and of a number of other elements in organic solvents containing organic acids is described. The solvents employed include aliphatic alcohols, acetone, and dioxane. As organic acids the monocarboxylic acids, such as formic, acetic, and propionic acid, and also chloro-derivatives of acetic acid, were investigated. Through the determination of the distribution coefficients and separation factors in the various media, separation methods for uranium from other elements were developed. (auth)

25306 EXTRACTION OF THE ZIRCONIUM–ALIZARIN S COMPLEX WITH BUTANOL. C. Dragulescu, T. Simonescu, and Septimia Policec (Academia Republicii Populare Romine, Baza de Cercetari Stiintifice, Timisoara, Romania). Talanta, 11: 747-55(May 1964).

Optimum conditions are established for the formation of the zirconium–alizarin S lake. Trichloracetic acid exerts a stabilization action over the lake in hydrochloric acid solutions, enabling extraction of the lake with butanol over a large range of pH. The butanol lake solutions are stable almost indefinitely. The distribution constant was determined, and the 1:1 composition of the complex in butanol proved by the continuous variations, the slope ratio and the molar ratio methods. Lambert-Beer's law is obeyed up to at least 11 μg of zirconium. The influence of elements commonly associated with zirconium in its natural compounds is less in butanol than in the case of determinations in an aqueous medium. (auth)

25307 THE DETERMINATION OF MERCURY IN ROCKS BY NEUTRON-ACTIVATION ANALYSIS. D. F. C. Morris and R. A. Killick (Brunel Coll., London). Talanta, 11: 781-8(May 1964).

A radioactivation method for the determination of the small concentrations of mercury that occur in rocks is

described. The procedure involves assay of the radioactivity of ^{197}Hg by use of a thin NaI(Tl) crystal scintillator. The applicability of such a detector in neutron-activation analysis is discussed. (auth)

25308 A NEW OXIDIMETRIC REAGENT: POTASSIUM DICHROMATE IN A STRONG PHOSPHORIC ACID MEDIUM. III. TITRIMETRIC DETERMINATION OF CERIUM^{III}. G. Gopala Rao, P. Kanta Rao, and S. Bhanojee Rao (Andhra Univ., Waltair, India). Talanta, 11: 825-37(May 1964).

The use of potassium dichromate for the potentiometric titration of cerium(III) in 12-13.5M phosphoric acid at room temperature was investigated. The method, which is accurate to ±0.35% for 30-120 mg of cerium/50 ml of titration solution, was applied to the determination of cerium in monazite sand and technical cerium carbonate. Methods were also developed for the differential potentiometric titration of iron(II) plus cerium(III), vanadium(IV) plus cerium(III), and iron(II) plus vanadium(IV) plus cerium(III) in the same solution. (auth)

25309 CORRECTION FOR THE SEPARATION OF HYDROGEN ISOTOPES DURING DISTILLATION IN THE DETERMINATION OF TRITIUM. C. J. Riley and H. Brooks (United Kingdom Atomic Energy Authority, Windscale Works, Cumberland, Eng.). Talanta, 11: 897-8(May 1964).

A method is described for calculating the correction factor for depletion of tritium on distillation in the determination of tritium in tritiated water. The method is based on the fact that the ratio of the concentration of tritium, in tritiated water in the liquid phase to that in the vapor phase at equilibrium is 1.036 ± 0.001 at 760 mm pressure. (P.C.H.)

25310 RADIOACTIVATION ANALYSIS. H. J. M. Bowen and D. Gibbons. New York, Oxford University Press, 1963. 300p. $8.00.

Information is included on: theory of activation analysis; activation by neutrons; activation by particles other than neutrons; gamma scintillation spectrometry; determination of radioactivity; errors in activation analysis; methods of separation of radionuclides; collection and preparation of material for activation analysis; geochemical applications of activation analysis; biological applications of activation analysis; inorganic and pure chemical applications of activation analysis; and radiochemical separations. 702 references are included. (P.C.H.)

25311 IMPROVEMENTS IN OR RELATING TO METHODS OF DETERMINING THE ASH CONTENT OF COAL. Alan Lyle Gray and Arnold Metcalf (to The Plessey Co. Ltd.). British Patent 960,408. June 10, 1964. Filed Feb. 5, 1960.

A direct-reading method is given for determining the ash content of coal. The method comprises irradiating the coal with neutrons, moving the coal from the radiation source to a detector, and detecting the ^{28}Al isotope through its gamma ray. An apparatus is described in which the irradiated coal is carried to the detector by a conveyor belt. (D.L.C.)

25312 APPARATUS FOR DETERMINING CONTAMINATION IN A SUBSTANCE BY MEANS OF RADIATION. (to Atomic Energy of Canada Ltd.). British Patent 960,618. June 10, 1964. Priority date June 1, 1960, Canada.

An apparatus for the infrared analysis of, e.g., light water in heavy water and vice versa, is designed which is not affected by entrained dirt or bubbles and which uses a simple optical system. The apparatus comprises an infrared source for irradiating the sample, two filters adapted to intercept the beam in sequence, a detector for receiving the radiation after it passes through the sample, integrating means for the detector output, means for presenting the outputs associated with the respective filters with opposite polarities to the integrating means, and means for balancing the outputs. One filter is arranged to pass a wavelength which is strongly absorbed by one component of the mixture and weakly absorbed by the other component, while the other filter is arranged to work in the other direction. A relay system for use with the apparatus is described in British Patent 960,619. (D.L.C.)

25313 RELAY SELECTOR SYSTEM. (to Atomic Energy of Canada Ltd.). British Patent 960,619. June 10, 1964. Priority date June 1, 1960, Canada.

A relay selector system is designed for sequential signals which occur in the infrared analysis of heavy water for light water contamination, such as is described in British Patent 960,618. The system comprises two photocells connected in series and arranged for connection across a d-c source, and a two-state relay with a winding. One side of the winding is connected to the photocell junction, and the other side is connected through a charge storage means to the d-c source, whereby the current flow through the winding causes the relay to be switched alternately between its two states in response to the alternate illumination of the photocells. (D.L.C.)

Inorganic and Physical Chemistry

Refer also to abstracts 25899 and 26625.

25314 (AI-64-75) SOLUBILITY AND DIFFUSION STUDIES OF ULTRA PURE TRANSITION ELEMENTS IN ULTRA PURE ALKALI METALS. Quarterly Report No. 3, December 29, 1963-March 28, 1964. R. L. McKisson, R. L. Eichelberger, G. R. Argue, and J. M. Scarborough (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). May 11, 1964. Contract NAS3-4163. 30p. (NASA-CR-54043)

The fabrication of the environmental test system is 90% complete. The outgassing furnace and the first test capsule furnace were assembled and are undergoing mock-up testing to ensure smooth operation. Auxiliary equipment items, which were delivered, are: the electron beam welder, the RYE manipulators, and the control set-point units. Two single crystals each of niobium, molybdenum, and tantalum were received. The one single crystal of molybdenum received had a flaw and was returned. The double layer capacitance method (DLC) was shown to be capable of giving reproducible values of refractory metal surface areas and will be used in the test program. Chemical analyses techniques for determining the impurities in sample materials were tested using the best materials available. In many cases, the procedures are capable of determining lower levels than are present in the best available sample materials. (auth)

25315 (AWRE-O-56/57) THE PERMEATION OF GASES THROUGH LATEX AND NEOPRENE. F. P. Evans (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Oct. 23, 1957. 22p.

The permeability of latex and neoprene is being studied. Results are given for the permeation of hydrogen, deuterium, oxygen, nitrogen, argon, arcton (CCl_2F_2), and helium. These results include the volume of gas diffusing through latex and neoprene gloves under standard conditions. It is shown

that there is in general a correlation between the rate of permeation and the diameter of the gas molecule. (auth)

25316 (BM-RI-6444) ELECTRODEPOSITION OF MOLYBDENUM METAL FROM MOLTEN ELECTROLYTES. Harold J. Heinen and J. B. Zadra (Bureau of Mines. Reno Metallurgy Research Center, Nev.). July 1963. 17p.

Electrowinning molybdenum from oxide feed materials dissolved in a variety of molten baths was investigated. A $NaCl-NaF-Na_2B_4O_7-MoO_3$ system operating at 1000°C in a cell without a protective atmosphere gave the best current efficiency, metal-to-cathode adherence, and purity of electrowon metal. Technical-grade molybdic oxide, containing associated impurities of aluminum, iron, copper, silicon, and tungsten in combined quantities of 10%, was used as feed material to produce dendritic crystals of molybdenum metal containing less than 0.5% total base metal, carbon, and oxygen impurities. Arc-melting molybdenum electrowon from either chemically pure or commercial-grade MoO_3 produced ingots, which contained less than 0.1% total impurities and had hardness readings of 168 to 200 Vhn. (auth)

25317 (CONF-405-31) SINGLE CRYSTAL SYNTHESIS AND PROPERTIES OF LANTHANIDE GERMANO-MOLYBDATES. C. B. Finch, L. A. Harris, and G. Wayne Clark (Oak Ridge National Lab., Tenn.). [nd]. Contract W-7405-eng-26. 13p.

From 4th Rare Earth Research Conference, Phoenix, Ariz., Apr. 1964.

A series of lanthanide germano-molybdates was synthesized as single crystals greater than 1 mm on edge. The general formula for the compounds is R_2GeMoO_8, where R = Pr, Nd, Gd, Tb, Dy, Ho, Er, or Yb. The crystals all had a body-centered tetragonal (scheelite type) structure with space group $I4_1/a$. The method of synthesis, crystal structure details, optical and magnetic properties are described. (auth)

25318 (CONF-405-39) RARE EARTH OXYFLUORIDES AND MIXED OXIDES, FLUORIDES AND OXYFLUORIDES WITH LITHIUM. Karl S. Vorres and Richard Riviello (Purdue Univ., Lafayette, Ind.). [1961]. Contract AT(11-1)-122. 5p.

From 4th Rare Earth Research Conference, Phoenix, Ariz., Apr. 1964.

Oxyfluorides of all of the rare earths except Pm were prepared from the fluorides by heating in air. Mixed fluorides with Li of the general formula $Li(RE)F_4$, where RE is rare earths, were prepared by solid state techniques for Gd through Lu and Y. The mixed oxides of Li of the general formula $Li(RE)O_2$ were reported for Dy through Lu and Y. Mixed oxyfluorides did not form under similar conditions. (auth)

25319 (COO-1140-103) LANTHANIDE BORIDE SYSTEMS AND PROPERTIES. PART I. LANTHANIDE–BORON–CARBON SYSTEMS. PART II. VAPORIZATION AND STABILITIES OF LANTHANIDE BORIDES (thesis). P. Kent Smith (Kansas. Univ., Lawrence). May 1, 1964. Contract AT(11-1)-1140. 485p.

Studies were made on: ternary phases and equilibria in Ln–B–C systems; structure of the phase, LnB_2C_2; discovery of the hectoboride phase; vaporization characteristics of rare earth borides; decomposition pressures and heat of sublimation of GdB_4; and ternary Ln–M–B compatibility studies and the boron potential series. The ternary Ln–B–C systems were investigated by arc melting and x-ray diffraction techniques. Emphasis was placed on the metal-deficient portion of the ternary Gd–B–C system. Five ternary phases were identified: GdB_2C_2, $Gd_{9.35}B_{9.19}C_{0.46}$, $Gd_7B_9C_4$, $Gd_3B_4C_3$, and $Gd_4B_7C_5$. The LnB_2C_2 phase was prepared for the lanthanides, Nd, Gd, Tb, Dy, Ho, Er, and Yb, by reaction of their tetraborides with graphite. It is proposed that the tetragonal LnB_2C_2 structure contains continuous planar sheets of alternate boron and carbon atoms arranged in eight- and four-membered aromatic rings between which lie the metal atoms. A primitive cubic phase of composition near LnB_{100} was found for Gd and Yb. The cell parameters were 16.50 and 16.56 Å, respectively. By free evaporation and Knudsen effusion techniques, it was found that tetraborides of the light lanthanide metals, La, Ce, Pr, Nd, and Sm, lose metal gas preferentially to produce a hexaboride residue, which vaporizes congruently. Hexaborides of Gd, Tb, Dy, and Y vaporize with preferential loss of boron gas to a tetraboride residue, which vaporizes congruently. Ytterbium gas is lost from YbB_4, YbB_6, and YbB_{12} to a YbB_{100} residue. A mass spectrometric study revealed only atomic species in the gas phase. The decomposition pressures of congruently vaporizing GdB_4 from ZrB_2 crucibles were measured in the range of 1599 to 2403°K by Langmuir, mass spectrometric, and Knudsen effusion techniques. It was demonstrated that variation in metal volatility alone was not sufficient to account for the difference in the vaporization behaviors of the borides. The stability of the borides with respect to condensed elements decreased with increasing atomic number, and the hexaboride became less stable faster than the tetraboride. Ternary compatibility studies between the lanthanide borides and Ta, Zr, W, and C were performed with arc melting and x-ray diffraction techniques to define the limits on the free energy of formation of the lanthanide borides. Emphasis was placed on the gadolinium borides. The concept of a boron potential series was developed to order the boride systems with respect to their ability to give up boron. (auth)

25320 (COO-1148-84) GRAPHITE INDICATING ELECTRODES: THEORY, METHODOLOGY AND APPLICABILITY. Philip J. Elving, Ilana Fried, and W. Richard Turner (Michigan. Univ., Ann Arbor). Apr. 28, 1964. Contract AT(11-1)-1148. 34p.

The carbon electrode in its various forms is an attempt to meet the need for a nonreactive indicating electrode, suitable for the study and utilization of electrode processes at positive potentials. The present discussion is primarily concerned with stationary and rotating wax-impregnated, carbon paste and pyrolytic graphite disk electrodes. The phenomenological theory of such electrodes centers on mass transport to the stationary or rotating disk surface and the resulting development of equations relating applied potential, current flow and time. Methodological problems involve the preparation, maintenance, and renewal of the electrode shape and surface, and the effect of experimental variables on the observed response. The response of graphite electrodes is compared to those of dropping-mercury and other indicating electrodes in respect to available potential range, behavior of reversible and irreversible inorganic and organic systems, etc. The applicability of the graphite electrode is systematically outlined in respect to its use in direct-current voltammetry, amperometric titration, chronopotentiometry, controlled potential electrolysis, and other electrochemical techniques both for the study of cathodic and anodic electrode processes, and for analysis and synthesis. (82 references). (auth)

25321 (GA-5215) CATALYSIS OF THE STEAM–GRAPHITE AND CARBON MONOXIDE DISPROPORTIONATION REACTIONS BY BARIUM, STRONTIUM, AND CESIUM. R. D. Burnette and L. R. Zumwalt (General Atomic Div., General Dynamics Corp., San Diego, Calif.). May 7, 1964. Contract AT(04-3)-167. 18p. (CONF-526-1)

From Libby/Cockcroft US/UK Meeting on Graphite Chemistry, Richland, Wash., May 1964.

The catalytic effects of barium, strontium, and cesium on the steam-graphite reaction and of barium and cesium on the CO disproportionation reaction for conditions and materials pertinent to a high-temperature graphite-moderated reactor were studied. Steam–graphite reaction rates appeared to vary linearly with barium or strontium concentration (at 0 to 1.4×10^{-4} mole fraction), and barium in general was a more effective catalyst than was strontium. Cesium was found to be noncatalytic. Activated carbon impregnated with barium catalyzed the disproportionation reaction. Catalytic enhancement of a factor of about 1000 was observed for a barium loading of 5 wt % and at 500°C. Cesium was found to be essentially noncatalytic. (auth)

25322 (GAMD-891(Rev.1)) FISSION PRODUCT ELEMENT YIELDS AND CHARACTERISTICS. L. R. Zumwalt (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Feb. 4, 1964. Contract AT(04-3)-314. 3p.

In considering the possible physical and chemical effects of fission product elements at high temperatures on graphites and other materials, a table of data on the fission yields of the elements taken as the sum of the yields of all mass chains ending with a stable nuclide of the given element or a nuclide that has a half-life of one year or more was compiled. This gives a distribution of the elements, which corresponds approximately to that obtained from ^{235}U where a fuel element has run for an extended period of time (order of a year). The fission yields were taken from Schmitt and Zumwalt who have compiled a reasonably up-to-date summary of thermal neutron, ^{235}U fission yields. Also included in the table are the boiling points of the elements and qualitative data on the carbides. The volatility category of the elements is listed. (auth)

25323 (HW-48782) THE USE OF METALLIC IRON IN THE PREPARATION OF URANIUM(IV) FLUORIDE SALTS FROM URANYL SULFATE. E. J. Wheelwright (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Feb. 26, 1957. Contract AT(45-1)-1350. 6p.

Conditions were determined under which UO_2SO_4 could be reduced to ^{4+}U by metallic iron. It was found that the uranyl sulfate is easily reduced by the addition of powdered iron and dilute sulfuric acid. Only 15 to 20% excess hydrofluoric acid was necessary for the recovery of 99.9% of the uranium(IV) as the anhydrous sodium uranium fluoride salt. The average iron contamination of the product was 118 ppm of uranium. The chemical costs of the process were calculated to be approximately $300 per ton of uranium. (M.C.G.)

25324 (K-1609) URANIUM DENSITY OF SYSTEMS INVOLVING MUTUALLY INSOLUBLE MATERIALS. Karl E. Rapp and R. L. Smitherman (Oak Ridge Gaseous Diffusion Plant, Tenn.). June 9, 1964. Contract W-7405-eng-26. 18p.

Critical masses, as they apply to the establishment of safe geometries, are altered by the involvement of hydrogen as a moderator. Theoretically, uranium compounds and hydrogen compounds which exhibit mutual insolubility should make proportional contributions to the composite uranium density of any system wherein they are combined. The uranium densities of four such systems were determined experimentally and the results obtained support the validity of the theory. Certain fundamental considerations were examined, which are potential sources of error in the application of these physical principles. (auth)

25325 (MLM-1161) COMPARATIVE PROPERTIES OF HELIUM-3 AND HELIUM-4. Donald P. Kelly and Walter J. Haubach (Mound Lab., Miamisburg, Ohio). July 1963. Contract AT-33-1-GEN-53. 56p.

The physical, thermodynamic, and quantum mechanical properties of helium-3 and -4 are presented graphically. Included are specific heat, vapor pressure, structure of solids and phase diagrams, allotropic forms, melting pressure, latent heat of fusion, latent heat of vaporation, viscosity, density and molar volume, expansion coefficient, thermal conductivity, velocity of sound, compressibility, surface tension, entropy, lambda point, and diffusion. (R.E.U.)

25326 (NAA-SR-Memo-9383) OUT-OF-PILE TEMPERATURE EVALUATION OF FISSION PRODUCT RETENTION IN SODIUM (900°–1400°F). D. M. Elliott and W. P. Kunkel (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Apr. 9, 1964. Contract AT-11-1-GEN-8. 31p.

An experiment was performed in a series of out-of-pile studies to evaluate the retention ability of sodium for iodine. This experiment, in which the iodine was released to the sodium directly from uranium metal fuel, was intended primarily to form a basis for the rest of the series and secondarily, to provide some initial retention data. The results indicated that the technology used was sufficient for experiments of this type. It was found that 0.087% of the iodine in the sodium was released to the helium cover gas as the sodium and fuel temperature was elevated from 900 to 1400°F. This activity was observed in the high temperature tubing. Only 2×10^{-4}% of the iodine in the sodium was observed downstream in the colder portions of the system tubing. (auth)

25327 (RT/GEO(64)-1)) ADSORPTION MEASUREMENTS BY MEMBRANE ELECTRODES. G. Rinelli (Italy. Comitato Nazionale per l'Energia Nucleare, Rome). Jan. 1964. 22p. (CONF-525-1)

From 6th International Mineral Processing Congress, Cannes, France, May–June 1963.

Experiments are described, which were carried out with a potentiometric technique and by means of membrane electrodes, for quantitative measurements of sodium and calcium ions adsorption on quartz. The electrodes were operated in the solid-liquid system with stirring. The method allowed reaction kinetics to be measured, and a relationship was derived, connecting adsorption quantities to the time. (auth)

25328 (SC-DC-64-864) BERYLLIUM STUDY PROGRAM. Quarterly Progress Report No. 2, January 1–March 31, 1964. J. L. Blumenthal and Myrrl Santy (Thompson Ramo Wooldridge Inc. TRW Space Technology Labs., Redondo Beach, Calif.). Apr. 14, 1964. For Sandia Corp., Albuquerque, N. Mex. Contract AT(29-1)-789 and 82-6211. 74p.

The reaction kinetics studies were continued, and investigations of the reactions of beryllium with nitrogen, air, and carbon monoxide in the temperature range from 1000 to 1500°C were completed. The effect of temperature, pressure, and surface coverage on the reaction kinetics was in-

vestigated. The results showed that at temperatures below the beryllium melting point (1284°C) the reaction of beryllium with carbon monoxide is as much as forty times faster than the reactions with oxygen and nitrogen. On the other hand, above the beryllium melting point, the oxygen reaction rate is faster than the nitrogen, air, or carbon monoxide reaction rates. The reaction of beryllium with dry air, above the melting point, was found to be very similar to the beryllium-nitrogen reaction. Microscopic studies of the combustion products formed from beryllium reactions, with oxygen, nitrogen, and carbon monoxide indicated that in all three cases products of airborne particle size (<10 microns) were formed. The fabrication of a vacuum test chamber suitable for carrying out higher temperature experiments and detailed planning of these tests was initiated. Preliminary torch experiments studying the reactions of copper and magnesium were begun. Thermochemical calculations of the theoretical flame temperatures and equilibrium compositions of methane-oxygen, hydrogen-oxygen, and acetylene-oxygen flames were carried out. (auth)

25329 (TID-20645) THE PRODUCTION AND IDENTIFICATION OF FREE RADICALS. Final Report. F. O. Rice (Georgetown Univ., Washington, D. C.). [196?]. Contract AT(40-1)-2590. 9p.

Methods of producing free radicals and stabilizing them sufficiently to keep them at room temperature are discussed. The matrix isolation method of stabilizing free radicals is described. Incorporation of radicals into an ionic lattice or in clathrate compounds or making a fluff on an unsaturated polymer so that the radicals are anchored on the surface as the site of a double bond are discussed. Preliminary studies of the pyrolysis of NO_2 as a possible means of effecting the reaction of neopentane with atomic oxygen are described. Positive evidence of neopentyl alcohol formation was not obtained in any of the experiments. However in the photolysis of mixtures of NO_2 and neopentane with rapid freezing out of the products, neopentyl alcohol was observed. (M.C.G.)

25330 (Y-1470-C) X-RAY FLUORESCENCE TABLES: LITHIUM FLUORIDE CRYSTAL. W. P. Amsbury, W. W. Lee, J. H. Rowan, and G. E. Walden (Union Carbide Corp. Nuclear Div. Y-12 Plant, Oak Ridge, Tenn.). Apr. 24, 1964. Contract W-7405-eng-26. 135p.

A critical compilation of standard reference tables of x-ray fluorescence lines calculated for a lithium fluoride crystal is presented. (auth)

25331 (AWRE-Trans-43) LITHIUM TETRABORATE. H. Gode. Translated by F. E. Wallwork (U.K.A.E.A. Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.), from Latvijas PSR Zinatnu Akad. Vestis, No. 3, 91-6(1949). 10p.

An attempt was made to prepare lithium tetraborate by dissolving lithium carbonate in a hot solution of boric acid. The characteristics of the product obtained largely resembled those of liquid glass. On addition of alcohol an apparently amorphous mass was precipitated. Analysis showed that a mixture of lithium borates was formed. The next attempt was made with the material dissolved in 3 times the volume of water. After some weeks a white film began to form on the walls of the vessel. This crystalline film was found to be the trihydrate of the tetraborate. Physical properties of this compound were determined. (M.C.G.)

25332 (UCRL-Trans-1044(L)) REACTION OF METALLIC TUNGSTEN AND FLUORINE GAS. Matae Iwasaki, Taneaki Yahata, Keizo Suzuki, and Keiichi Oshima. Translated for Univ. of California, Lawrence Radiation Lab., Livermore, from Kogyo Kagaku Zasshi, 65: 1165-7(1962). 15p.

Various forms of tungsten were reacted by fluorine gas, which was diluted to a certain composition by nitrogen gas, and the relationship of its reaction speed to the form of the sample was examined. The result of this examination showed that in the case of the powdered sample, the reactivity was not determined by the size of the grains and that the larger the nitrogen-adsorbing surface area, the higher the reactivity. It also showed that certain kinds of powdered samples have a high reactivity at the beginning, but drop rapidly to a constant value. It also showed that the reaction-starting temperature is 200°C for the powdered sample and 300°C for the cylindrical sample. During the reaction process, most of the tungsten was fluoridated directly into tungsten fluoride (VI) without producing any intermediate product, except for a very small quantity of what is believed to be oxidized material noted on the inner wall of the reaction tube. Identification of the reaction product as tungsten fluoride (VI) was made by infrared absorbance. (auth)

25333 POLAROGRAPHIC BEHAVIOR OF DYSPROSIUM(III) IN AQUEOUS SOLUTIONS. Robert F. Large and Andrew Timnick (Michigan State Univ., East Lansing). Anal. Chem., 36: 1258-64(June 1964).

Two-step polarograms are recorded with Dy(III) in aqueous 0.1M LiCl, 0.01% gelatin. On varying the pH from 2.6 to 4, $E_{\frac{1}{2}}$ for the first step changes from −1.85 to −1.735 v vs S.C.E. At constant pH, i_d for the first step varies linearly over the concentration range 0.2 to 5.0 mM. $E_{\frac{1}{2}}$ for the first step is shifted to more negative potentials and the second step disappears when D_2O is used as the solvent. A suspension of a lanthanide hydrous oxide yields a one-step wave, which coincides with the second step of the normally recorded polarogram. These observations lead to the conclusion that two-step polarograms recorded with solutions containing lanthanide ions, which do not yield dipositive ions in aqueous solutions, result from the reduction of H ions produced by the hydrolysis of the hydrated lanthanide ions in the immediate vicinity of the electrode and the subsequent reduction of additional H ions from water associated with the adsorbed lanthanide hydrous oxide. (auth)

25334 ROTATION SPECTRA OF $^{32}S^{18}O^{18}O$ AND $^{32}S^{16}O^{18}O$ IN THE (0,1,0) STATE. R. Van Riet (Université, Louvain, Belg.). Ann. Soc. Sci. Bruxelles. Ser. I, 78: 90-6(Apr. 2, 1964). (In French)

Rotation transitions attributable to the molecules $^{32}S^{18}O^{18}O$ and $^{32}S^{16}O^{18}O$ in the first excited state of vibration, ν_2, were observed and identified. Rotation constants and distortion coefficients are given to the first-order approximation of Kivelson. (tr-auth)

25335 ROTATION SPECTRA OF $^{32}S^{16}O^{18}O$ IN THE (0,0,0) STATE. R. Van Riet (Université, Louvain, Belg.). Ann. Soc. Sci. Bruxelles. Ser. I, 78: 97-104(Apr. 2, 1964). (In French)

Rotation transitions in the molecule $^{32}S^{16}O^{18}O$ in the ground state were observed and identified. Rotation constants and distortion coefficients were calculated in the first-order approximation (Kivelson theory). The frequencies of the rotation-spectrum lines were recalculated using these derived parameters; the agreement between the observed and calculated values is satisfactory. (tr-auth)

25336 DISSOCIATION OF ACETYLENE MOLECULE IONS FORMED IN CHARGE EXCHANGE COLLISIONS

WITH POSITIVE IONS. ION-MOLECULE REACTIONS OF ACETYLENE. E. Lindholm, I. Szabo, and P. Wilmenius (Royal Inst. of Tech., Stockholm). Arkiv Fysik, 25: 417-24(1964).

Mass spectra of acetylene were obtained after charge exchange with slow positive ions. The differential cross sections for the formation of different fragments are plotted as a function of the energy absorbed by the molecule during the charge exchange. From this graph two ionization potentials can be determined: the normal at 11.4 ev and the second at about 15.5 ev. Some ion-molecule reactions have been studied. The condensation reaction of $C_2H_2^+$ with C_2H_2 depends on the manner of formation of $C_2H_2^+$. (auth)

25337 ABOUT THE REACTIONS OF HYDROLYSIS AND ISOMERIZATION OF SOME SYSTOX COMPOUNDS. W. Dedek (Institut für Angewandte Radioaktivität, Leipzig). Atompraxis, 10: 164-7(Apr. 1964). (In German)

By means of ^{32}P-labeled compounds the rate constants of the hydrolysis and isomerization reactions of 4 insecticide thiophosphates of the Systox type are measured. The results may be interpreted corresponding with known hypotheses. (auth)

25338 FREE ENERGY OF TRANSFER OF ELECTROLYTES FROM WATER TO HEAVY WATER. L. G. Hepler (Univ. of New England, Armidale, New South Wales). Australian J. Chem., 17: 587-90(May 1964).

The free energy of transfer of Cl^- ions from water to heavy water was calculated. The Born equation for the electrostatic free energy of one mole of univalent ions, $G = Ne^2/2\ \epsilon_0 r_s = k/\epsilon_0 r_s = 1.66 \times 10^5/\epsilon_0 r_s$ Å cal/mole, where N, e, ϵ_0, and r_s represent Avogadro's number, the charge of one electron, the ordinary macroscopic dielectric constant, and the radius of the ion in solution, respectively, was used. However, the dielectric constant was considered to be a variable quantity that assumes small values for a solvent near an ion. The calculations indicate that ΔG is about 15 cal/mole for transfer of Cl^- ions from H_2O to D_2O and that ΔG is a little more than 100 cal/mole for transfer of ions having r_s near 1 Å. (P.C.H.)

25339 THE CHANGE OF LANDE'S INTERVAL PARAMETER FOR U(IV) AND THE NEW SPECTROCHEMICAL SERIES. B. Jeżowska-Trzebiatowska and K. Burietyńska (Univ. of Wroclaw, Poland). Bull. Acad. Polon. Sci., Ser. Sci. Chim., 12: 123-6(1963).

An investigation was made on the $5f^2$ electronic structure of UCl_4 in solution with the aim of finding an explanation of the influence of the ligand field on the energy levels of U(IV). The magnitude of splitting of the ^3P term ($^3P_2 - {}^3P_1$ multiplet interval) was assumed as a measure of the influence of the ligand and was defined according to Lande's interval law. It is shown that this magnitude alters with the change of the solvent. From the absorption spectra obtained, ζ_{3p} values were derived. From this the ligands in a spectroscopic series were arranged in the order of increasing ζ_{3p} values: R–OH < TBP = TiAP < DEPA < Cl^- < R′ – CN < H_2O ≤ THF, where: R–OH–the alcohols, TBP–tributylphosphate, DEPA–diethyl phosphate, TiAP–triisoamylphosphate, R′CN–acetonitrile, benzonitrile, and THF–tetrahydrofuran. (P.C.H.)

25340 THERMODYNAMIC PROPERTIES OF URANIUM(IV) CHLORIDE IN DILUTED FUSED EUTECTIC LiCl–KCl SOLUTIONS. A. Kisza (Inst. of Structural Research, Polish Academy of Sciences, Wroclaw and Univ. of Wroclaw, Poland). Bull. Acad. Polon. Sci., Ser. Sci., Chim., 12: 177-82(1964).

The thermodynamic properties of UCl_4 dissolved in the fused eutectic LiCl–KCl were determined by means of emf measurements. The activity coefficients of UCl_4 showed very large negative deviations from those for ideal solutions. It is believed that this may be caused by formation of complex ions in the melt. Data are tabulated. (P.C.H.)

25341 THE COMPLEX FORMATION OF BORON FLUORIDE WITH LOWER OLEFINS AT LOW TEMPERATURES. II. ISOTOPE EFFECTS AND ABSORPTION SPECTRA OF BORON FLUORIDE–BUTENE SYSTEMS. Ryohei Nakane, Tsunao Watanabe, and Toshiyuki Ōyama (Inst. of Physical and Chemical Research, Tokyo). Bull. Chem. Soc. Japan, 37: 381-5(Mar. 1964).

The equilibrium constants of isotopic exchange between boron fluoride gas and boron fluoride in 1-butene and cis-2-butene solutions were found to be 1.017 ± 0.002 and 1.020 ± 0.002 at −112°C, and 1.012 ± 0.002 and 1.015 ± 0.002 at −95°C. In the boron fluoride–trans-2-butene system, the equilibrium constant is 1.011 ± 0.002 at −112°C and 1.006 ± 0.002 at −95°C. When 1-butene and ethylene are dissolved in liquid boron fluoride, the intensity or the wave number of the V ← N absorption bands in mono-olefins is changed and the fine structure of these bands disappear. It was concluded that boron fluoride can form liquid σ-complexes with polar mono-olefins with electron-releasing substituents. On the other hand, with nonpolar mono-olefins it cannot form σ-complexes but only unstable π-complexes. Although σ-complexes are not the intermediate products in reactions by boron fluoride catalysts, it is possible that these reactions proceed through π-complexes. However, the rate-determining step does not involve the initial formation of π-complexes. It is also suggested that the equilibrium constant may be proportional to the ratio of dative to no-bond structure in the complex, and it was found that the larger the equilibrium constant, the higher the stability and the catalytic activity of the complexes become. (P.C.H.)

25342 ACTUAL POSSIBILITIES OF THE INDUSTRIAL APPLICATIONS OF DENITRATION PROCESSES IN THE FRENCH URANIUM REFINING CYCLE. J. Muller and P. Nollet. Bull. Inform. Sci. Tech. (Paris), No. 80, 87-101 (Feb. 1964). (In French)

The physicochemical and economic aspects of denitration are summarized. The various industrial denitration processes are then reviewed, and the possibility of incorporating them into the refining circuits of the French plants is considered. A UO_2 pilot production plant at Le Bouchet that uses the denitration–granulation process is briefly described. (D.C.W.)

25343 STUDY OF THE PREPARATION OF SINTERABLE URANIUM DIOXIDE FOR THE FABRICATION OF EL4 FUEL. J. Holder. Bull. Inform. Sci. Tech. (Paris), No. 80, 103-15(Feb. 1964). (In French)

The results of a development program on the process to be used in the production of UO_2 for the first fuel charge of the EL4 reactor are presented. The effects of various parameters during the calcination and reduction operations were investigated with a view to industrial sintering in a continuous furnace. Attempts at industrial production confirmed the research results and gave a suitable sintered material. (D.C.W.)

25344 ABSORPTION SPECTRA OF HYDROFLUORIC ACID SOLUTIONS OF PENTAVALENT PROTACTINIUM. Carlos Ferreira de Miranda and Roland Muxart (Institut du Radium, Arcueil, France). Bull. Soc. Chim. France, No. 2, 387-9(Feb. 1964). (In French)

The absorption spectra of Pa^{5+} in hydrofluoric acid solu-

tions were measured in the visible and ultraviolet. The effects of concentration and pH and the evolution of the spectra with the age of the solutions were examined. (tr-auth)

25345 INFLUENCE OF INSTRUMENT FACTORS ON THE MEASUREMENT OF IONIZATION POTENTIALS BY MASS SPECTROMETRY. J. Delwiche. Bull. Soc. Roy. Sci. Liege, 32: 854-62(1963). (In French)

The influence of the magnetic field in a 180° mass spectrometer upon the numerical value of the ionization potential of a molecule, as determined by electron impact, was investigated for the cases of argon and carbon dioxide. The experimental results indicate no such influence, in agreement with theoretical calculations. (auth)

25346 THEORY OF THE Q BRANCH OF THE INFRARED SPECTRUM OF SOLID HYDROGEN. V. F. Sears, and J. Van Kranendonk (Univ. of Toronto). Can. J. Phys., 42: 980-1003(May 1964).

The theory of the zero-phonon Q branch of the infrared spectrum of solid hydrogen is developed. At low orthoconcentrations the spectrum can be analyzed in terms of transitions due to single orthomolecules and neighboring orthomolecule pairs. The $Q_1(1)$ transitions due to single orthomolecules give rise to a sharp absorption line, the $Q_1(0)$ transitions to a band with a total width of about 3 cm^{-1} and a line profile following approximately a $\Delta\nu^{-\frac{1}{2}}$ law. The integrated intensities of these lines are calculated and compared with the experimental data. The $Q_1(1)$ and $Q_1(0)$ transitions due to pairs of orthomolecules give rise to a number of components resulting from the removal of the ninefold degeneracy of the orientational state of the orthomolecule pair by the quadrupole-quadrupole interaction. The intensities and frequency separations of these components are calculated. Finally, a calculation is presented of the total integrated intensity of the zero-phonon Q branch at arbitrary orthoconcentrations. These theoretical results are of importance for the study of the percolation problem in solid hydrogen, and of the order-disorder transition taking place at high orthoconcentrations. (auth)

25347 MÖSSBAUER ABSORPTION LINE SPECTRUM OF FERROUS GLUCONATE AND ANHYDRATED FERROUS SULFATE. Poh-kun Tsing (National Taiwan Univ., Taipei) and Shou-yu Wang. Chinese J. Phys. (Taiwan), 1: 81-2 (Oct. 1963).

Line spectra were obtained at room temperature, using a source of ^{57}Co in stainless steel and absorbers of ferrous gluconate, $FeSO_4$, and $FeSO_4 \cdot 7H_2O$. The spectrum with $FeSO_4 \cdot 7H_2O$ was taken as a standard to find the velocity coordinates for the other spectra. The following values were obtained for $FeSO_4$ and ferrous gluconate, respectively: ΔE-0.277 ± 0.010 and 0.317 ± 0.010 cm/sec; δ-0.138 ± 0.010 and 0.130 ± 0.010 cm/sec. (D.C.W.)

25348 THE SOLIDIFIED INERT GASES. G. Boato (Università, Genoa). Cryogenics, 4: 65-75(Apr. 1964).

The properties of solidified inert gases are discussed, with emphasis on the differences between molecular solids and other types. The effect of zero-point energy on their properties is also considered in some detail. Experimental results are discussed in relation to theoretical advances. 70 references. (D.C.W.)

25349 AN EMPIRICAL EQUATION FOR THE HELIUM-4 VAPOUR PRESSURE SCALE BETWEEN 1.36 AND 2.16°K. R. G. Scurlock and E. M. Wray (Univ. of Southampton, Eng.). Cryogenics, 4: 104(Apr. 1964).

A suitable equation for the vapor pressure scale was found by fitting several empirical equations to the scale by the least squares method. The equation involves seven parameters (specified). (D.C.W.)

25350 MAGNETIC BEHAVIOUR OF RARE-EARTH IONS IN STATE OF SOLUTION. A. Mookherji and T. Mookherji (Univ. of Burdwan, India). Current Sci. (India), 32: 543(Dec. 1963).

Measurements of the magnetic moment (μ) of the available rare earth ions of spectroscopic purity by a sensitive microbalance revealed that moment values in solution are always less than those in the crystalline state. Data are tabulated. (P.C.H.)

25351 STUDIES ON THE PRECIPITATION OF CERIUM(IV) AND LANTHANUM WITH MALONIC, SUCCINIC, ADIPIC (AND PHTHALIC) ACIDS. B. D. Jain and S. P. Singhal (Univ. of Delhi). Current Sci. (India), 33: 210-11 (Apr. 5, 1964).

Studies on the precipitation of Ce and La with malonic, succinic, adipic, and phthalic acids showed that Ce is partially precipitated by malonic acid but succinic, adipic, and phthalic acids precipitate it nearly quantitatively in the pH range 3.0 to 7.0. Lanthanum forms a soluble complex with malonic acid in the pH range 3.0 to 7.0 while it is largely though not quantitatively precipitated by succinic and adipic acids in the pH range 4.0 to 7.0. Data are tabulated. (P.C.H.)

25352 THE REDUCTION OF TECHNETIUM(VII) BY HYDROCHLORIC ACID. D. I. Ryabchikov and A. A. Pozdnyakov (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSR, 155: 153-5(Mar. 1, 1964). (In Russian)

A possible mechanism for the reduction of TcO_4^- in HCl solution was determined by a spectrochemical study of the behavior of technetium in an HCl solution combined with the results of extraction experiments. No changes in the absorption spectrum of TcO_4^- could be observed up to 7 to 7.5M HCl, but in 10M HCl, peaks appeared at 230 and 293 mμ, whose molar absorption coefficients were 10,400 and 4700, respectively. Tc(VII) was completely reduced to Tc(IV) in 100 hours at room temperature, and in about 1 hour at a boiling temperature. The buildup of Tc(IV) was measured by the increase in the peak at 338 mμ with time. Attempts to extract Tc as the thiocyanate complex from concentrated HCl solution were unsuccessful. Apparently Tc(VII) was reduced to Tc(IV) without the formation of an intermediate Tc(V) state. It is proposed that Tc(VII) is first reduced to Tc(VI), which disproportionates according to the following reaction: Tc(VI) → Tc(VII) + Tc(IV). The long reaction time is understandable on the basis of this disproportionation reaction. (TTT)

25353 PRASEODYMIUM(IV) NITRATE. J. Soriano and Y. Marcus (Israel Atomic Energy Commission, Yavne). Inorg. Chem., 3: 901-2(June 1964).

Experimental results proving the existence of Pr(IV) nitrate are reported. The preparation of Pr nitrate the same way Nd nitrate was prepared produced only a 10% yield. Using dinitrogen pentoxide, instead of tetroxide, increased the yield of Pr(III) nitrate 20% at room temperature. Raising the temperature to 70°C increased the yield to complete nitration. Dissolution of the nitromethane-washed precipitate in water gave a clear pale green solution, showing the characteristic Pr(III) spectrum. Analysis of the aqueous solutions obtained in this way showed, however, a nitrate-to-praseodymium ratio always greater than three. It is suggested that these results are due to the presence of some Pr(IV) in the preparation, which decom-

poses on dissolution in water to produce acid and the extra nitrate. The oxidizing power of the preparations was measured with iodide, and the results agreed with the nitrate-to-praseodymium ratio, indicating 6 to 7% Pr in the tetravalent state. (P.C.H.)

25354 THERMOGRAVIMETRIC ANALYSIS OF FIVE SALTS OF PRASEODYMIUM, NEODYMIUM, AND SAMARIUM. Roy L. Wilfong, Louis P. Domingues, and LeRoy R. Furlong (Bureau of Mines, College Park, Md.). J. Am. Ceram. Soc., 47: 240-1(May 1964).

The thermal decomposition of the ammonium sulfate, carbonate, nitrate, oxalate, and sulfate salts of praseodymium, neodymium, and samarium was investigated thermogravimetrically in the temperature range 25 to 1400°C. Each salt was decomposed at a heating rate of 2.5°C per minute. The pyrolytic sequences were identified, and the temperatures of formation of intermediates and of the sesquioxides were determined. The sesquioxide formation temperatures increased in the order samarium, neodymium, and praseodymium irrespective of the anion. The nonstoichiometric ranges between Pr_6O_{11} and Pr_2O_3 and the extent of these ranges were determined for oxides derived from the carbonate, nitrate, and oxalate salts of praseodymium. The nonstoichiometric oxides of praseodymium were not observed in the decomposition of the alum and sulfate salts. (auth)

25355 THERMAL EXPANSION OF YTTRIUM OXIDE AND OF MAGNESIUM OXIDE WITH YTTRIUM OXIDE. T. H. Nielsen and M. H. Leipold (California Inst. of Tech., Pasadena). J. Am. Ceram. Soc., 47: 256(May 1964).

The thermal expansion of polycrystalline yttrium oxide and of magnesium oxide plus 3 wt % yttrium oxide was measured in both high-oxygen and argon-hydrogen atmospheres to above 2000°C. The results of the tests on Y_2O_3 indicated no significant difference in the values of the expansion. During the tests, permanent expansion of the Y_2O_3 specimens occurred in both test atmospheres above 2000°C. The Y_2O_3 specimen tested in the argon-hydrogen atmosphere lost 0.3% weight. A reaction between the argon-hydrogen atmosphere and the specimen surface occurred at some temperature above 1375°C. The results of tests on MgO plus 3 wt % Y_2O_3 also showed no significant difference in the values of the expansion in the two atmospheres. During the tests the specimens sintered, as indicated by a decrease in length and an increase in density. (P.C.H.)

25356 SYNTHESIS AND SINGLE-CRYSTAL GROWTH OF RARE-EARTH ORTHOPHOSPHATES. R. S. Feigelson (Sperry Rand Corp., Sudbury, Mass.). J. Am. Ceram. Soc., 47: 257-8(May 1964).

The technique employed for the single-crystal growth of RPO_4-type rare earth phosphates, where R can be any rare earth ion from La to Lu and including Y, involves the dissolution and reaction of rare earth oxides in molten lead pyrophosphate ($Pb_2P_2O_7$) at high temperatures, and recrystallization of RPO_4 on cooling. The rare earth orthophosphates produced by the high-temperature flux method had crystal structures identical to similar compounds previously reported. Lattice parameters for $SmPO_4$, $EuPO_4$, and $GdPO_4$ are tabulated along with calculated density. Morphology characteristics of the monoclinic and tetragonal phosphates differed. Monoclinic crystals were platelike, while tetragonal crystals varied from a needlelike external configuration to a more platelike crystal habit with decreasing cation radius. (P.C.H.)

25357 HYDROLYSIS OF XENON HEXAFLUORIDE AND THE AQUEOUS SOLUTION CHEMISTRY OF XENON. E. H. Appelman and J. G. Malm (Argonne National Lab., Ill.). J. Am. Chem. Soc., 86: 2141-8(June 5, 1964).

Both XeF_4 and XeF_6 hydrolyze in water to produce aqueous solutions of nonvolatile XeO_3 molecules. The solutions are stable, but they are strongly oxidizing, rapidly liberating chlorine from strong HCl. The Xe–Xe(VI) potential is estimated to be 1.8 v in acid and 0.9 v in base. The XeO_3 molecule is a weak acid, forming $HXeO_4^-$ above pH 10.5. In strongly basic solution Xe(VI) disproportionates to give xenon gas and octavalent xenon, while in such solutions ozone oxidizes Xe(VI) nearly quantitatively to Xe(VIII). Sodium and Ba salts of Xe(VIII), perxenates, were characterized, with typical compositions $Na_4XeO_6 \cdot 2.2H_2O$ and $Ba_2XeO_6 \cdot 1.5H_2O$. A salt of mixed oxidation state, $K_4XeO_6 \cdot 2XeO_3$, was also observed. Aqueous solutions of sodium perxenate evolve oxygen slowly to give Xe(VI). The reaction becomes almost instantaneous below pH 7. Octavalent xenon is an extremely powerful oxidizing agent, rapidly oxidizing iodate to periodate and Mn^{2+} to permanganate. The Xe(VI)–Xe(VIII) potential is estimated at 3.0 v in acid and 0.9 v in base. In basic solution Xe(VIII) is present as the ion $HXeO_6^{3-}$. Below pH 10 the principal species becomes $H_2XeO_6^{2-}$. Both Xe(VI) and Xe(VIII) have characteristic, pH-dependent, ultraviolet absorption spectra that can be attributed to the several species present. (auth)

25358 CHARACTERIZATION OF DIVALENT XENON IN AQUEOUS SOLUTION. Evan H. Appelman and John G. Malm (Argonne National Lab., Ill.). J. Am. Chem. Soc., 86: 2297-8(June 5, 1964).

XeF_2 was hydrolyzed in 20 ml of water to yield a colorless solution with a pungent odor. It was analyzed 50 min after mixing and was found to contain 4.6 m equiv. of oxidizing power, which at 0°C was lost with a half life of about 7 hr. Extrapolation to the time of mixing gave an initial yield of 5.0 m equiv. or 87% of the oxidizing power present in the XeF_2. At room temperature the decomposition was much faster. After 30 hr at ca 24°C less than 0.03% of the original oxidizing power remained. The decomposed solution was found to contain 5.62 mmoles of HF, compared to 5.76 mmoles calculated from the weight of XeF_2 taken. The gases evolved on decomposition of this solution were found to consist of Xe and O_2 in the ratio 2.08 : 1. It was concluded that XeF_2 dissolves in water to the extent of about 0.15 M and is present in solution as undissociated molecules, which do not form complex anions with F^-. (P.C.H.)

25359 SPECTRUM OF TRIVALENT ERBIUM ION IN THE MATRIX OF CALCIUM FLUORIDE. S. A. Pollack (TRW Space Tech. Labs., Redondo Beach, Calif.). J. Chem. Phys., 40: 2751-67(May 15, 1964).

The absorption and emission spectra of $CaF_2:Er^{3+}$ are presented, discussed, and analyzed phenomenologically. The crystalline states are listed and identified with the free ion quantum numbers by comparison with the states of erbium chloride. The oscillator strengths are determined from the absorbance spectrum and compared with the oscillator strengths reported in the literature. The study of the emission properties of the erbium ion in CaF_2 includes identification of transition schemes for the major emission groups from their excitation spectra, measurements of relative intensities, decay times of fluorescence, and quantum efficiencies. The natural lifetimes and fluorescence yields were calculated using data obtained from the absorbance spectrum. By combining data obtained from the absorption and emission spectra at 77 and 4°K, the crystalline field splitting of the ground $^4I_{15/2}$ multiplet was

determined. The wavelengths of all emission lines at 77°K are presented, including those whose origin could not be identified. The effects of temperature and ion concentration are discussed. All pertinent data are tabulated. The important features of the absorption and emission spectra are amply illustrated by figures, graphs, and tables. In addition to the purely spectroscopic properties of $CaF_2:Er^{3+}$, its properties as a potential laser material are considered and discussed. The discussion is complemented by calculation of the threshold power requirements. (auth)

25360 VAPOR PRESSURES AND VAPOR THERMODYNAMIC PROPERTIES OF SOME LITHIUM AND MAGNESIUM HALIDES. D. L. Hildenbrand, W. F. Hall, F. Ju, and N. D. Potter (Philco Corp., Newport Beach, Calif.). J. Chem. Phys., 40: 2882-90(May 15, 1964).

The vapor pressures of LiF, LiCl, MgF_2, and $MgCl_2$ were measured by the torsion-effusion method. The lithium halide vaporization data have been analyzed to yield heats of sublimation of monomer and dimer species which are consistent with available data on vapor composition, heats of dimerization, and the normal boiling points. Derived heats of sublimation of monomer and dimer at 298°K are 66.5 and 71.6 kcal/mole for LiF and 51.0 and 52.0 kcal/mole for LiCl, respectively. An analysis of the data obtained here and other vaporization data on the magnesium halides indicates that the available entropy and free-energy functions for $MgF_2(g)$ and $MgCl_2(g)$ may be low by 4 to 5 cal/mole deg. Possible reasons for the discrepancy are discussed. The heats of sublimation of $MgF_2(g)$ and $MgCl_2(g)$ at 298°K are calculated to be 93 and 59 kcal/mole, respectively. (auth)

25361 NUCLEAR MAGNETIC RESONANCE IN MOLTEN SALTS. I. CHEMICAL SHIFT OF CRYSTALLINE AND MOLTEN THALLIUM SALTS. Stefan Hafner and Norman H. Nachtrieb (Univ. of Chicago). J. Chem. Phys., 40: 2891-8(May 15, 1964).

Relatively large chemical shifts in the resonance frequency of the thallium nucleus are observed in both the crystalline and molten states of different salts. Relative to $TlNO_3$, which appears to be the most ionic of all thallium salts studied, the ^{205}Tl resonance frequency at fixed field increases in the order: $NO_3^- < Cl^- < Br^- < I^-$. The results are interpreted in terms of a second-order paramagnetic contribution to the field at the Tl nucleus, arising from an admixture of its excited states with the ground state, and the chemical shift is approximately proportional to the square of the overlap integral. Although cations and anions in the melts are partly associated, the NMR shifts of the Tl nucleus show that the cause arises from incipient covalency rather than polarization of the cation by the halide ions. In both the crystalline and molten states, a linear paramagnetic shift with temperature is observed, which is attributed to the enhanced overlap of excited states induced by thermal vibrations. (auth)

25362 CALCULATION OF HARD-SPHERE VISCOSITY BY MEANS OF CORRELATION FUNCTIONS. T. Wainwright (Univ. of California, Livermore). J. Chem. Phys., 40: 2932-7(May 15, 1964). (UCRL-7625-T)

The viscosity of a system of hard-sphere molecules is calculated under the assumption that terms in the autocorrelation of the stress tensor are in the form of a decaying exponential. The results are in close agreement with those of Enskog. (auth)

25363 ELECTRICAL PROPERTIES OF THE CERIUM AND GADOLINIUM HYDROGEN SYSTEMS. Richard C. Heckman (Sandia Corp., Albuquerque, N. Mex.). J. Chem. Phys., 40: 2958-63(May 15, 1964).

Conductivities of polycrystalline solid samples of cerium hydride and gadolinium hydride were measured over the composition ranges H/Ce = 0–2.5 and H/Gd = 0–2.13 at room temperature and at elevated temperatures (400°–750°C). Conduction is metallic and the results for the two systems are very similar. The conductivity in the variable composition dihydride phase of each system decreases with increasing hydrogen content and is explained assuming that the hydrogen is anionic, taking its extra electron from the system's conduction band. Measurements of absolute Seebeck coefficients ($CeH_{2.37}$, −17 μv/°C; $GdH_{2.12}$, −6 μv/°C) support this model. The measured conductivity curves extrapolate to zero at $CeH_{2.7}$ and $GdH_{2.3}$. For the dihydride phases the composition dependencies of the conductivities are used to calculate carrier mobilities. The values obtained are in the range 1 to 10 cm^2/v-sec. The conductivities of compositions H/M = 0 to 2 show that the dihydrides can exist with hydrogen-to-metal ratios much less than 2.0. Ionic conduction has been found not to be important to the conduction mechanism from the results of a concentration cell measurement. (auth)

25364 COMPUTED POTENTIAL CURVE AND SPECTROSCOPIC CONSTANTS FOR BERYLLIUM OXIDE GROUND STATE IN MOLECULAR ORBITAL APPROXIMATION. M. Yoshimine (International Business Machines Corp., San Jose, Calif.). J. Chem. Phys., 40: 2970-6 (May 15, 1964).

A set of single-configuration self-consistent field molecular orbital wavefunctions for the $^1\Sigma$ ground state of BeO is presented. A potential curve which is approximately 0.3 ev above the Hartree-Fock potential cruve for the molecule is presented, together with the results of a spectroscopic analysis on it. A further calculation at a nuclear separation corresponding to the minimum in the computed potential curve, which gives a total molecular energy of −89.44787 a.u., is presented. This is probably less than 0.1 ev above the Hartree-Fock limit. The mean value of the dipole moment of the molecule computed with this wavefunction is 7.29 D. A comprehensive selection of other mean values computed at points along the potential curve, and for the more accurate calculation at the minimum in the curve, is given. (auth)

25365 HEAT CAPACITIES OF SOLID DEUTERIUM (33.1%–87.2% PARA) FROM 1.5°K TO THE TRIPLE POINTS. HEATS OF FUSION AND HEAT CAPACITY OF LIQUID. George Grenier and David White (Ohio State Univ., Columbus). J. Chem. Phys., 40: 3015-30(May 15, 1964).

The heat capacities of a number of deuterium samples enriched in para content were measured in the temperatrue range 1.5° to 22°K. The variation of the triple points and heats of fusion as a function of ortho-para composition were measured. All the heat capacities of the solid show anomalies due to the quenching of the molecular rotation of the J = 1 species present in the mixtures. For para compositions above 60% para-D_2 a sharp λ transition is observed. A linear dependence of the transition temperature with para content is observed. The high-temperature heat capacities of the solid shows a dependence on ortho-para composition, suggesting a structural dependence on composition. A calculation of the entropy from the data shows that the threefold degeneracy of the J = 1 species is completely removed at the absolute zero. An analysis of the anomalies resulting from the removal of the degeneracy confirm Nakamura's conclusions that the quenching of the molecular rotations is principally a result of quadrupolar interactions. The anomalous heat capacities of the solid,

at sufficiently high temperatures, are expressed by the relation, $CT^2/R = \alpha x + \beta x^2$, just as in the case of hydrogen. The ratio of the experimental β's for the two isotopes is in excellent agreement with the theoretical ratio. This ratio is a measure of quadrupolar interactions in the two isotopic solids. (auth)

25366 NUCLEAR MAGNETIC RESONANCE SPECTRUM OF ^{11}B AND B–Si ORDER IN DANBURITE, $CaB_2Si_2O_8$. E. Brun and Subrata Ghose (Universität, Zürich and Eidgenossische Technische Hochschule, Zurich). J. Chem. Phys., 40: 3031-3(May 15, 1964).

The nuclear magnetic resonance spectrum of ^{11}B in danburite, $CaB_2Si_2O_8$, structurally closely related to the feldspars, was investigated. Boron occupies a single crystallographically unique site. Thermal experiments indicate that B–Si order persists up to the decomposition temperature (~1000°C). The quadrupole coupling constant, the asymmetry parameter of the electric field gradient tensor, and the orientation of the principal axes of the electric field gradient tensor were determined. (auth)

25367 CALCULATION OF HEAT CAPACITIES AND COMPRESSIBILITIES OF LIQUIDS FROM A RIGID SPHERE EQUATION OF STATE. S. J. Yosim (Atomics International, Canoga Park, Calif.). J. Chem. Phys., 40: 3069-75(May 15, 1964).

Equations for heat capacities and compressibilities of liquids were calculated by differentiation of the expression for the entropy of a fluid of rigid spheres. The resulting equations contain no adjustable parameters. The information required in addition to the heat capacity and compressibility of the gas, is the diameter of the molecule, the liquid density and its variation with temperature. The equations were applied to the rare gases and to diatomic and polyatomic molecules at their boiling points. Agreement between the calculated and observed values was with few exceptions very good. Further, the calculated temperature dependence showed good agreement with experimental values. (auth)

25368 ON THE SPECTRUM AND STRUCTURE OF WATER AND IONIC SOLUTIONS. D. F. Hornig (Princeton Univ., N. J.). J. Chem. Phys., 40: 3119-20(May 15, 1964).

Comment is made on the assignment of 8620, 8330, and 8000 cm^{-1} absorption peaks in the near-infrared spectrum of water to free molecules, molecules forming one hydrogen bond, and molecules forming two hydrogen bonds by Buijs and Choppin (NSA, 17: 40802, 40803). The validity of conclusions from spectral analyses are questioned. It is concluded that no evidence is available on the existence of separate H_2O species in water or for a variation in the degree of hydrogen bonding as ions are added. (R.E.U.)

25369 ASSIGNMENT OF THE NEAR-INFRARED BANDS OF WATER AND IONIC SOLUTIONS. K. Buijs (Centre d'Etude de l'Energie Nucleaire Mol-Donk, Belg.) and G. R. Choppin. J. Chem. Phys., 40: 3120(May 15, 1964).

Comment is made on previous papers (NSA, 17: 40802, 40803) and rebuttals made on the assignment of absorption peaks in the near-infrared spectra of water and ionic solutions, and in their interpretation with respect to bonding and H_2O species contributions. (R.E.U.)

25370 ON THE ORTHO-PARA CONVERSION IN SOLID HYDROGEN. Guenter Ahlers (Univ. of California, Berkeley). J. Chem. Phys., 40: 3123-4(May 15, 1964). (UCRL-11042)

The rate constant for the ortho-para conversion in the solid was investigated at three volumes by measuring the initial and final ortho hydrogen concentrations of samples kept at constant volume for 5 to 7 hr. The rate constant was found to be 0.755 V^{-1}, where V is volume in cc/mole. (R.E.U.)

25371 CHEMILUMINESCENCE OF H_2O_2–NaOCl SOLUTIONS. H. H. Seliger (Johns Hopkins Univ., Baltimore). J. Chem. Phys., 40: 3133-4(May 15, 1964).

The red (3000 to 7500 Å) chemiluminescence emission bands resulting from the rapid mixing of 30% H_2O_2 with reagent-grade sodium hypochlorite were studied. The existence of a metastable level of molecular oxygen was investigated. (R.E.U.)

25372 THE NATURE OF THE BONDING IN XENON FLUORIDES AND RELATED MOLECULES. C. A. Coulson (Mathematical Inst., Oxford). J. Chem. Soc., 1442-54(Apr. 1964).

A survey is given of four distinct theories that have been proposed to describe the bonding in fluorine compounds of xenon, and related molecules. It is shown that a valence-bond resonance picture is the simplest satisfactory description, but a molecular-orbital picture may also be used and is of great value in characterizing the various possible electronic transitions. Further, an explicit relation is obtained between the wave functions corresponding to the two models. The significance both of the large size and low ionization potential of the central (heavy) atom, and of the small size and high electron-affinity of the ligand atoms, is stressed. (auth)

25373 ISOTOPE EFFECTS IN PHASE EQUILIBRIA. A NEW TOOL FOR THE STUDY OF INTERMOLECULAR FORCES. Jacob Bigeleisen (Eidgenossische Technische Hochschule, Zurich). J. Chim. Phys., 61: 87-91(Jan.-Feb. 1964).

A summary is presented of correlations to intermolecular forces from the general theory of isotope effects in phase equilibria using the quantum partition function. A new set of molecular parameters are reported for monatomic neon, krypton, and xenon. The isotope effect on melting is discussed in terms of the structure of the solid and the nearest-neighbor numbers of the liquid. A qunatitative investigation of the rotation-vibration interaction for polyatomic molecules was made by the study of the vapor pressures of the deuteroethylenes. The summary was taken from 44 experimental and theoretical papers. (R.E.U.)

25374 CHROMATOGRAPHY ON ION EXCHANGE PAPERS. XII. THE ADSORPTION OF METAL IONS ON VARIOUS ANION EXCHANGE PAPERS— FURTHER RESULTS. G. Bagliano, G. Grassini, M. Lederer, and L. Ossicini (CNEN, Rome). J. Chromatog., 14: 238-43 (Apr. 1964).

Data on the behavior of metal ions on various anion exchange papers in HCl, LiCl, and HBr are given and the mechanism of the adsorption is discussed. The results confirmed that both adsorption and ion exchange contribute to the retention of ions on the various exchangers and that the differences between HCl and LiCl may be interpreted as a salting out effect, affecting those ions that are held by adsorption. (P.C.H.)

25375 ION FLOTATION OF INORGANIC IONS. 1. THE CONCENTRATION OF URANIUM. Alberto Barocas, Carla Iacobelli-Turi, and Franço Salvetti (CNEN, Rome and Università, Rome). J. Chromatog., 14: 291-4(Apr. 1964).

The concentration of UO_2^{2+} ions from a solution of ammonium carbonate in ion flotation is discussed. The effects of the carbonate concentration, of the concentration of the

surface active agent, and of the uranyl ion concentration are illustrated. Concentrated foam fractions were analyzed for their surface active agent and uranyl ion contents and gave ratios of 4 : 1, indicating the formation of a salt fo the type $R_4^+UO_2(CO_3)_3^{4-}$. For the determination of benzethonium, spectrophotometry at 240 mμ gave good results in the required range of concentrations. Experiments with anionic exchange resins showed similar adsorptions with various carbonate concentrations as obtained in foams. It was concluded that a broad analogy between ion flotation and ion exchange can be inferred even for the working conditions such as carbonate concentration and pH. (P.C.H.)

25376 COPPER-ACTIVATED THORIUM PHOSPHATE PHOSPHORS. William F. Schmid and Richard W. Mooney (Sylvania Electric Products Inc., Towanda, Penna.). J. Electrochem. Soc., 111: 668-73(June 1964).

Eight different copper-activated thorium phosphate phosphors were prepared, identified, and their fluorescence properties measured. The brightest phosphors, with their fluorescence maxima, are: $Th_3(PO_4)_4$: 0.045 Cu, 440 nm and 540 nm; $Th_3(PO_4)_4$: 0.48 Cu, 590 nm; $Th_2Cu(PO_4)_3$, 590 nm; $Th_2Li(PO_4)_3$: 0.04 Cu, 455 nm; and $Th_2Ag(PO_4)_3$: Cu, 565 nm. The copper concentration has a pronounced effect on the fluorescence color and phosphor composition. All the phosphors except $Th_2Ag(PO_4)_3$: Cu have good temperature dependence. If the proper coating technique is used, the phosphors are highly efficient in high pressure mercury vapor lamps. (auth)

25377 CHARGE TRANSFER BETWEEN OXYGEN ATOMS AND O^+ AND H^+ IONS. R. F. Stebbings, A. C. H. Smith, and H. Ehrhardt (General Atomic Div., General Dynamics Corp., San Diego, Calif.). J. Geophys. Res., 69: 2349-55(June 1, 1964).

The cross sections for charge transfer between O atoms and O^+ and H^+ ions were determined within the energy range 40 to 10,000 ev in a crossed-beam experiment. It is observed that the variation of the cross section Q with energy E for each of these processes can be well represented by an expression of the form $Q^{1/2} = a - b \log E$, which is characteristic of symmetric resonance charge transfer. The magnitudes of these cross sections at energies appropriate to those in the upper atmosphere are estimated, as well as the influence of excited states on the measurements. (auth)

25378 ION EXCHANGE ON AMMONIUM MOLYBDOPHOSPHATE. II. BIVALENT AND TRIVALENT IONS. J. van R. Smit and W. Robb (South African Council for Scientific and Industrial Research, Pretoria). J. Inorg. Nucl. Chem., 26: 509-18(Apr. 1964).

In acid solution, bivalent and trivalent ions do not exchange significantly with ammonium 12-molybdophosphate (AMP), but they absorb well from solutions of pH 2-5. For efficient adsorption of macro quantities of trivalent ions on columns, the feed solution has to be buffered at a suitable pH. The alkaline earth ions are readily eluted with a moderately concentrated solution of an ammonium salt, but for rapid elution of trivalent ions a distinctly acid eluant is required. The ion exchange behavior of monovalent, bivalent, and trivalent ions on AMP is sufficiently different to allow simple group separations. The mechanism of the exchange adsorption of multivalent ions on AMP is discussed. (auth)

25379 THE PREPARATION AND PROPERTIES OF A ZIRCONIUM AND HAFNIUM PEROXY COMPOUND. E. M. Larsen, P. M. Hurst, D. Vissers, and F. Gil Arnao (Univ. of Wisconsin, Madison). J. Inorg. Nucl. Chem., 26: 519-24(Apr. 1964).

Zirconium and hafnium compounds dissolve in a cold alkaline solution of hydrogen peroxide from which a white solid of composition $Na_2O : Mo_2 : O_a : H_2O$, 0.40 : 1.00 : 1.20 : 1.0, precipitates upon warming. The product takes up carbon dioxide with loss of peroxide to 0.8 O_a/MO_2. The resulting product has an infrared spectrum characteristic of basic carbonates. The products with or without carbonate exchange sodium for other cations. (auth)

25380 STUDIES ON EDTA COMPLEXES. II. URANYL-EDTA SYSTEM. T. R. Bhat and M. Krishnamurthy (Atomic Energy Establishment, Trombay, India). J. Inorg. Nucl. Chem., 26: 587-94(Apr. 1964).

The uranium(VI)-EDTA system was investigated spectrophotometrically. Evidence is presented for the formation of complexes, UO_2YH^-, $(UO_2)_2Y$, $UO_2(OH)YH^{2-}$, $(UO_2OH)_2Y^{4-}$ and their formation constants determined. (auth)

25381 SOLVENT EXTRACTION BEHAVIOURS OF THE LANTHANIDES IN PERCHLORIC ACID—TRI-n-BUTYL PHOSPHATE SYSTEM. Hiroyuki Yoshida (Japan Atomic Energy Research Inst., Tokyo). J. Inorg. Nucl. Chem., 26: 619-25(Apr. 1964).

Solvent extraction behaviors of the lanthanides in $M^{3+}/HClO_4/TBP$ system were investigated. Distribution ratio of the lanthanides was found to be third-power dependent upon the concentration of perchlorate ion in the aqueous phase and six power dependent upon the concentration of TBP in the organic phase. The extraction of the lanthanides is represented by the equation $(M^{3+})_a + 3(ClO_4^-)_a + 6(TBP)_0 \rightleftharpoons [M(ClO_4)_3(TBP)_6]_0$ and the species existing in the TBP phase is probably $[M(ClO_4)_3(TBP)_6]$. Distribution ratio decreases with atomic number in the lanthanide series. (auth)

25382 EXTRACTION OF SOME METAL BROMIDES BY TRI-n-BUTYL PHOSPHATE. D. F. C. Morris, E. L. Short, and D. N. Slater (Brunel Coll., London). J. Inorg. Nucl. Chem., 26: 627-33(Apr. 1964).

The distribution of tracer quantities of manganese(II), cobalt(II), nickel(II), nickel(II), copper(II), and zinc(II) between tri-n-butyl phosphate (TBP) and aqueous solutions containing bromide was studied. The extractability of each transition element is greater from concentrated lithium bromide solution than from concentrated hydrobromic acid. Anionic metal-bromide complexes occurring in TBP extracts were identified from measurements of absorption spectra. (auth)

25383 ANION EXCHANGE BEHAVIOUR OF URANIUM AND THORIUM IN MIXED SOLVENT SYSTEMS. L. W. Marple (Iowa State Univ., Ames). J. Inorg. Nucl. Chem., 26: 635-41(Apr. 1964). (IS-671)

The adsorption of uranium(VI) and thorium on Dowex 1-X8 resin from alcoholic hydrochloric and nitric acid solutions was measured. In each case, the acidity of the solutions was sufficiently low that the sorption mechanism could be considered as a distribution of the neutral complex between two phases. Correspondingly, the relationships of log D vs mole fraction alcohol were examined and were found to be linear in all cases. This indicates that the major factor that affects the distribution is the change in the free energy of solvation of the neutral complex with change in alcohol content. (auth)

25384 THE SORPTION OF LEAD ON ANION EXCHANGE RESIN FROM NITRIC ACID-ISOPROPYL ALCOHOL-WATER MIXTURES. L. W. Marple (Iowa State Univ., Ames). J. Inorg. Nucl. Chem., 26: 643-53 (Apr. 1964). (IS-664)

The formation of lead–nitrate complexes in HNO_3–water–isopropyl alcohol solutions was studied by the polarographic

method. Successive formation constants for the first and second complexes in 25, 80, and 90% isopropyl alcohol solutions were found ot be 1.0 (μ = 1.5), 14 (μ = 1.5), 154 (μ = 1.0), respectively. Using data from the polarographic study, it was possible to correlate the distribution coefficient of lead with the mole fraction alcohol using the relation $\log D = -\Delta F/RT + \log \{\beta_2(NO_3^-)^2/[1 + \beta_1(NO_3^-) + \beta_2(NO_3^-)^2]\}$. The free energy change for the transfer of the neutral complex of the neutral complex from the solution phase to the resin phase, $-\Delta F$, should vary linearly with the mole fraction alcohol in solution. This was confirmed by the linear relationship of log D vs $n_{alcohol}$ and $\log \{\beta_2(NO_3^-)^2/[1 + \beta_1(NO_3^-) + \beta_2(NO_3^-)^2]\}$ vs $n_{alcohol}$ (auth)

25385 DETERMINATION OF STEP-WISE COMPLEXITY CONSTANTS OF HOLMIUM AND YTTERBIUM ACETYLACETONATES BY ION EXCHANGE METHOD. J. Prasilova (Faculty of Technical and Nuclear Physics, Prague). J. Inorg. Nucl. Chem., 26: 661-2(Apr. 1964).

The step-wise complexity constants K_n were determined for the reaction between acetylacetone and rare earths, holmium and ytterbium, by the ion exchange method. The results have been compared with the complexing constants previously determined by the potentiometric method. (auth)

25386 THE ANODIC OXIDATION OF CHLORIDE TO PERCHLORATE ON A SEMI-MICRO SCALE. J. E. Billigmeier and R. L. McDonald (North Dakota State Univ., Fargo). J. Inorg. Nucl. Chem., 26: 663-5(Apr. 1964).

A method for the anodic oxidation of LiCl or $CaCl_2$ to perchlorate is described. A non-compartmentalized cell was designed that gives good conversion of LiCl to $LiClO_4$ while operating with a total liquid volume of 3 ml or less. It was concluded that it is possible to obtain high yields of perchlorate from small volumes of relatively dilute LiCl solutions. Using high specific activity $H^{36}Cl$ neutralized with Li_2CO_3, $K^{36}ClO_4$ was prepared with no loss in the radiochlorine to total chlorine ratio. (P.C.H.)

25387 COMPLEXES OF 1,10-PHENANTHROLINE WITH LANTHANIDE CHLORIDES AND THIOCYANATES. F. A. Hart and F. P. Laming (London Univ.). J. Inorg. Nucl. Chem., 26: 579-85(Apr. 1964).

Several types of complexes of lanthanide chlorides and thiocyanates with 1,10-phenanthroline were isolated. The complexes, which are well crystalline, have moderate to very high thermal stability but dissociate in solution. Structures are proposed and the bonding is discussed. (auth)

25388 STRUCTURAL STUDIES ON Li_4UO_5 AND Na_4UO_5. H. Hoekstra and S. Siegel (Argonne National Lab., Ill.). J. Inorg. Nucl. Chem., 26: 693-700(May 1964).

A complete crystal structure determination of Li_4UO_5 and Na_4UO_5, based on x-ray and neutron diffraction data, is given. The compounds are body-centered tetragonal, space group $14/m\text{-}C^5_{4h}$, with two molecules in the unit cell. The cell parameters are a = 6.736, c = 4.457 Å for Li_4UO_5 and a = 7.576, c = 4.641 Å for Na_4UO_5. The infrared spectra of these compounds are shown to be in accord with the structures. (auth)

25389 CHEMISTRY OF THE LANTHANONS. XIII. THE STABILITIES OF THE ACETYLACETONATES, PROPIONYLACETONATES AND BENZOYLACETONATES OF La, Pr, Nd, AND Y. N. K. Dutt and P. Bandyopadhyay (University Coll. of Science, Calcutta and Indian Association for the Cultivation of Science, Calcutta). J. Inorg. Nucl. Chem., 26: 729-36(May 1964).

The stabilities of several β-diketonates of La, Pr, Nd, and Y were measured. The complexes are shown to dissociate stepwise in all the series. Plot of pK values against ionic radii of different lanthanons reveals that the stability increases with decreasing ionic size that is with decreasing basicity. (auth)

25390 OBSERVATIONS ON THE ACTION OF HYDROGEN PEROXIDE ON TRIVALENT AND TETRAVALENT PLUTONIUM SOLUTIONS. P. V. Balakrishnan and A. S. Ghosh Mazumdar (Atomic Energy Establishment, Trombay, India). J. Inorg. Nucl. Chem., 26: 759-65(May 1964).

When hydrogen peroxide is added in small portions, but in excess, either to pure Pu(III) or to pure Pu(IV) in acid solutions, a mixture of both the oxidation states is produced, the ratio of which is constant at a fixed composition of the medium, total Pu concentration being constant. In perchloric acid medium, this steady state ratio changes from 0.12 to 0.19, as the concentration of the acid increases from 4 to 8M, when the total Pu concentration is maintained at 0.01M. In sulfate–perchlorate medium on the other hand, the steady state ratio increases sharply from 0.38 to 5.01, as the bisulfate ion concentration increases from 0.096 to 0.48M in ionic strength of 2.0. Finally in hydrochloric acid medium, the steady state ratio increases from 0.10 at 2M to 0.25 at 6M and then rapidly to 30 at 7.5M hydrochloric acid. Total Pu concentration does not affect the steady state ratio so long as the same is above a certain minimum, the value of which depends upon the hydrochloric acid or bisulfate ion concentration; but below this minimum Pu concentration, the steady state changes in favor of Pu(IV). The results are discussed. (auth)

25391 EQUILIBRIUM STUDIES OF URANYL COMPLEXES. I. INTERACTION OF URANYL ION WITH SOME HYDROXYCARBOXYLIC AND AMINOCARBOXYLIC ACIDS. K. S. Rajan and A. E. Martell (Illinois Inst. of Tech., Chicago). J. Inorg. Nucl. Chem., 26: 789-98(May 1964).

A quantitative study of the interaction of uranyl ion with 5-sulfosalicylic acid (SSA), iminodiacetic acid (IMDA), and N-hydroxyethyliminodiacetic acid (HIMDA) was carried out potentiometrically. Stability constants of the uranyl chelates containing a 1:1 ratio of metal to ligand were determined at 25°C in media maintained at 0.1 and 1.0 ionic strengths with K nitrate. The hydrolysis and dimerization constants of the 1:1 uranyl HIMDA chelate are reported. Possible structures for the various species present in solution are indicated on the basis of an analysis of the potentiometric data. (auth)

25392 OXALATO COMPLEXES OF NEPTUNIUM(IV). B. M. L. Bansal and H. D. Sharma (Atomic Energy Establishment, Trombay, India). J. Inorg. Nucl. Chem., 26: 799-805(May 1964).

The complex formation of Np(IV) ions with oxalate ions was studied by measuring the equilibrium solubility at various oxalic acid concentrations of $Np(C_2O_4)_2 \cdot 6H_2O$ in perchloric acid medium maintaining an ionic strength of 1 at 26 ± 2°C. It was found that the data so obtained could be interpreted by assuming that the complexes in solution were $Np(C_2O_4)^{2+}$, $Np(C_2O_4)_2$, and $Np(C_2O_4)_3^{2-}$. The values of the complexity constants $\beta_j = (MA_n)/(M)(A)$ j were calculated from the data as $\beta_1 = (4.3 \pm 0.1) \times 10^9$; $\beta_2 = (7.65 \pm 0.2) \times 10^{16}$; $\beta_3 = (4.9 \pm 0.2) \times 10^{23}$. The values were also checked by solvent extraction methods using TTA as a chelating agent. The visible spectra of the complexes show a shift in their characteristic absorption bands when a ligand molecule enters the complex. (auth)

25393 COMPLEX FORMATION IN THE NEODYMIUM NITRATE–TRIBUTYL PHOSPHATE–WATER SYSTEM. H. Bostian and M. Smutz (Ames Lab., Ames, Iowa). J. Inorg. Nucl. Chem., 26: 825-36(May 1964). (IS-735)

The solvent extraction system, Nd nitrate–tributyl phosphate–water, was studied to obtain information on the nature of solvent-solute complex formation. Infrared spectra of the organic phase and composition and weight measurements made with equilibrium experiments led to three primary conclusions: complexing takes place at the P=O bond on the solvent molecule; dependence of extraction on solvent structure variation suggests that the complex is formed by weak intermolecular attractions depending on dipole effects. The reaction for complex formation can be represented approximately by

$$[Nd(NO_3)_3]_{aqueous} + [3\ TBP \cdot H_2O]_{organic} \rightarrow [Nd(NO_3)_3 \cdot 3\ TBP]_{organic} + [3\ H_2O]_{aqueous}$$

over the entire concentration range, from dilute to saturated. The latter information may be useful in devising equilibrium data prediction methods needed for extraction process design for fractionating the lanthanides on a macroscopic scale. Additional data were obtained on tributyl phosphate synthesis with different butyl alcohols; water solubilities, refractive indices, and infrared spectra of the synthesized tri-n-, tri-iso, and tri-sec-butyl phosphates were obtained. The tri-tert-butyl phosphate could not be synthesized, probably due to steric effects. (auth)

25394 THE BEHAVIOUR AND STRUCTURE OF URANYL NITRATE IN ORGANIC SOLVENTS. II. INVESTIGATIONS OF ANHYDROUS URANYL NITRATE SOLUTIONS IN ALCOHOLS BY CONDUCTIVITY METHOD. B. Jezowska-Trzebiatowska and S. Ernst (Wroclaw Univ., Poland). J. Inorg. Nucl. Chem., 26: 837-43(May 1964).

An investigation was made on the conductance of anhydrous uranyl nitrate solutions in methanol, ethanol, and propanol. The results obtained were analyzed by the Fuoss-Edelson and Fuoss-Kraus methods. The limiting molar conductivity $\Lambda_{0_{mole}}$ and association constants of ion pairs K_A were obtained. Dissociation free energies of the ion pairs ΔG and Bjerrum's parameters were also calculated. In alcoholic solutions the first stage of dissociation or uranyl nitrate was assumed as for a 1:1 electrolyte giving the two ions $UO_2NO_3^+$ and NO_3^-. K_A values of 10^3 to 10^5 point to a weak dissociation of anhydrous uranyl nitrate. Comparing the values of the association constants and dissociation free energies of anhydrous and uranyl nitrate hexahydrate in these solvents it is obvious that the anhydrous salt is a weaker electrolyte than the hexahydrate. (auth)

25395 THE SORPTION OF RARE EARTHS ON ANION EXCHANGE RESINS FROM NITRIC ACID-MIXED SOLVENT SYSTEMS. L. W. Marple (Iowa State Univ., Ames). J. Inorg. Nucl. Chem., 26: 859-64(May 1964).

The sorption of La, Dy, and Yb on anion exchange resins from nitric acid–isopropyl alcohol–water mixtures was studied in detail. The distribution function of La shows a maximum that appears to be caused by the invasion of isopropyl alcohol into the resin phase at high mole fractions of alcohol. This is supported by indirect evidence obtained from the effects of polarity of organic solvent, temperature, cross-linkage of resin, and complexing agent on the distribution functions. The size of the maximum decreases as the atomic number increases, and as a result, large differences in distribution coefficients are obtained at high mole fractions of alcohol. The separation of the rare earths by use of Amberlite IRA 400 resin and 0.5M HNO_3–95% isopropyl alcohol eluent is suggested. (auth)

25396 DTA AND THERMOGRAVIMETRIC STUDY OF LANTHANUM, PRASEODYMIUM, NEODYMIUM AND SAMARIUM PERCHLORATES. M. Steinberg and I. Shidlovsky (Hebrew Univ., Jerusalem). J. Inorg. Nucl. Chem., 26: 887-90(May 1964).

Results on the thermal decomposition of some hydrated tervalent perchlorates, using the thermogravimetric and DTA methods are presented. The thermographs indicated a weight gain in all the lanthanon perchlorates investigated, which reached its maximum in the 120 to 160°C temperature range. The gain in weight was due to the hygroscopic properties of the perchlorates prepared, and the maximum did not occur at the same temperature in experiments carried out on days of different relative humidity. In the DTA experiments, no thermal effect due to absorption of water was observed. Decomposition of the perchlorates to the LnOCl (Ln = La, Pr, Nd, Sm) terminates in the temperature range of 440 to 460°C, in good agreement with TG experiments. In the case of La and Sm, the temperatures observed for the thermogravimetric experiments were higher than the DTA results. (P.C.H.)

25397 STRUCTURE AND MAGNETISM OF $LiGdO_2$ AND $NaGdO_2$. G. Blasse (Philips' Gloeilampenfabrieken, Eindhoven, Netherlands). J. Inorg. Nucl. Chem., 26: 901-2 (May 1964).

The structure and magnetic properties of $LiGdO_2$ and $NaGdO_2$ were investigated. The unit cell of $LiGdO_2$ is orthorhombic with lattice parameters a = 5.33, b = 11.34, and c = 3.45 Å. $NaGdO_2$ is isomorphous with $LiFeO_2$ and its unit cell is tetragonal with lattice parameters a = 4.66 and c = 10.53 Å. Both compounds remained paramagnetic down to 4°K. (P.C.H.)

25398 THE REACTIONS OF NIOBIUM AND TANTALUM PENTACHLORIDES AND PENTABROMIDES WITH SOME SULPHOXIDES. D. B. Copley, F. Fairbrother, K. H. Grundy, and A. Thompson (Univ. of Manchester, Eng.). J. Less-Common Metals, 6: 407-12(May 1964).

The reactions of dimethyl sulfoxide and diphenyl sulfoxide with niobium and tantalum pentachlorides and pentabromides were investigated. The reactions involve abstraction of the oxygen atom of the sulfoxide group by the metal atom, to form the corresponding oxyhalide and halogen substituted sulfides, together with co-ordination of further molecules of the sulfoxide to the oxyhalide. The oxyhalide–sulfoxide adducts were isolated and characterized by analysis, mp, and a study of their infrared spectra. (auth)

25399 PRODUCTION OF HIGH-PURITY URANIUM BY ELECTROREFINING IN MOLTEN SALT BATHS. G. Chauvin (CEN, Saclay, France), H. Coriou, P. Jabot, and A. Laroche. J. Nucl. Mater., 11: 183-92(Feb.-Mar. 1964). (In French)

The technique of obtaining very pure U by electrolysis of molten salt mixtures (LiCl–KCl–UCl_3) at 450 to 500°C, was improved. The U is intended principally for fundamental metallurgical studies. The apparatus developed has a capacity of about 1000 kg of refined U annually. Individual deposits weigh 5 to 10 kg, the cathodic yield is 65 to 70%. The purity of the refined metal is most satisfactory; most metallic impurities are present in amounts below the limit of detection. The importance of the following precautions is emphasized: The use of anhydrous baths, since traces of moisture have a very noxious effect, not only on the purity but also on yield and partial size. The thorough removal, by washing, of salt adhering to the cathode, because impurities are concentrated in the neighborhood of the cathode. The account is rounded off by some general comments, especially on the mechanism of electrolytic refining. (auth)

25400 DETERMINATION OF STOICHIOMETRIC NUMBER OF HYDROGEN ELECTRODE REACTION IN THE PRESENCE OF ISOTOPIC EFFECT. Akiya Matusda and Reiko Notoya (Hokkaido Univ., Japan). J. Res. Inst. Catalysis, Hokkaido Univ., 11: 193-4(Feb. 1964).

Modification of a basic equation for determining the stoichiometric number of the rate-determining step $\nu(r)$ of a hydrogen electrode reaction is given for the presence of an isotopic effect in the reaction. (P.C.H.)

25401 THE CHEMISTRY OF NOBLE GASES. Asok Kumar Mukherjee (Indian Assn. for the Cultivation of Science, Calcutta). J. Sci. Ind. Res., 23: 103-5(Mar. 1964).

A brief review is presented on the discovery, methods of preparation, chemical properties, electronic theories of bonding, and structure of compounds of rare gases. Special attention is given to xenon fluorides. (P.C.H.)

25402 CONVERSION OF URANIUM HEXAFLUORIDE TO URANIUM DIOXIDE. H. Vietzke (NUKEM, Nuklear-Chemie und -Metallurgie GmbH, Ger.). Kerntechnik, 6: 176-7(Apr. 1964). (In German)

Steps in the oxidation of UF_6 to UO_2 are described. The reactions include: $UF_6 + 2H_2O \rightarrow UO_2F_2 + 4HF$, $UO_2F + 4HF + NH_3 \rightarrow UO_2F_2 + 4NH_4F$ or $UO_2F_2 + 3(NH_4)_2CO_3 \rightarrow (NH_4)_4UO_2(CO_3)_3 + 2NH_4F$. The $(NH_4)_4UO_2(CO_3)_3$ is heated at 200 to 400°C to form UO_3, CO_2, and $(NH_4)_2CO_3$ and then heated further at 400 to 600°C to convert the UO_3 into U_3O_8 and oxygen. The U_3O_8 is reduced to UO_2 in a hydrogen stream at 700°C. (M.C.G.)

25403 PREPARATION OF URANIUM COMPOUNDS. F. Ploeger (NUKEM, Nuklear-Chemie und -Metallurgie GmbH, Ger.). Kerntechnik, 6: 177-8(Apr. 1964). (In German)

Preparation and purification of uranyl nitrate, thermal decomposition to form uranium oxide, conversion of the oxide to hexafluoride, and reduction to uranium metal are described. (M.C.G.)

25404 ANODIC OXIDE COATINGS ON TUNGSTEN. H.-J. Booss (OSRAM, GmbH, Berlin). Metall, 18: 466-8 (May 1964). (In German)

Oxidized tungsten layers were (prepared by polarization in nitric acid. Between the layer thickness and the applied voltage a linear relation, $\overline{X} = 18$ Å/V, existed. The diffusion of these layers was followed. (tr-auth)

25405 A REMARK ON THE STRUCTURE OF NON-STOICHIOMETRIC UO_2. R. L. Colombo (Fiat, Sezione Energia Nucleare, Turin). Nucl. Sci. Eng., 19: 243-4 (June 1964).

Evidence is presented that seems to favor an oxygen-excess structure of non-stoichiometric UO_2. (C.E.S.)

25406 LOW-TEMPERATURE SPECTRA OF DIVALENT SAMARIUM IN ALKALI-HALIDE SINGLE CRYSTALS. A. A. Kaplyanskii and P. P. Feofilov. Opt. Spectry. (USSR) (English Transl.), 16: 144-9(Feb. 1964).

Absorption and luminescence spectra of alkali-halide single crystals activated by divalent samarium ions were investigated at 4.2°K. A distinct electron-vibrational structure was established in the low-temperature absorption spectra, which were interpreted as allowed transitions to levels of a mixed $4f^55d$ configuration. The luminescence spectra noted at 4.2°K consist of narrow lines corresponding to forbidden transitions within the bounds of a $4f^6$ configuration ($^5D_0 - {}^7F_{0-6}$) and of a structural background connected with forbidden transitions from levels of the $4f^55d$ configuration. A sharp difference was observed in the decay times of the lines ($\tau \approx 10^{-2}$ sec) and of the background ($\tau < 10^{-5}$ sec) at 4.2°K, which indicates absence of thermal equilibrium in the system of excited states. (auth)

25407 THE BAND SPECTRUM OF THORIUM OXIDE. G. Edvinsson and L.-E. Selin (Univ. of Stockholm). Phys. Letters, 9: 238-9(Apr. 15, 1964).

The first two bands in a sequence, situated at $\lambda = 7868$ Å and belonging to a strong system of red-degraded bands, were rotationally analyzed. The bands consist of an R, a Q, and a P branch, each splitting into two components at higher J numbers. (M.J.T.)

25408 DISCRETE PHONON AND ZERO-PHONON OPTICAL ABSORPTION SPECTRA IN ALKALI HALIDES. C. B. Pierce (Sandia Lab., Albuquerque, N. Mex.). Phys. Rev., 135: A83-6(July 6, 1964).

In addition to 0-phonon lines associated with the R_2 and N bands of a number of the alkali halides at low temperature, other subsidiary peaks often occur on the high-energy side of the 0-phonon line. Peaks on the R_2 and N bands of LiF, NaCl, KCl, and KBr, and on the N bands only of NaF and KI were observed. It is found with very few exceptions that energy separations between the 0-phonon lines and associated subsidiary peaks agree very well with theoretical normal lattice phonon energies near the zone boundary. The most common lattice coupling to the defects appears to be through transverse acoustical phonons propagating in ⟨100⟩ directions, although in most of the materials the defects are coupled with comparable strength to several phonon modes. Indeed, possible correlations with all normal modes are indicated. The exceptions (on the N bands of NaCl, KCl, and KBr) are all considerably smaller in energy than any of the lattice phonons at the zone boundary. These exceptions may be associated with pseudolocalized modes due to resonance scattering. Also, 0-phonon lines alone were observed on the R_2 bands of NaF, KF, and KI. (auth)

25409 STRONG AXIAL ELECTRON PARAMAGNETIC RESONANCE SPECTRUM OF Fe^{3+} IN $SrTiO_3$ DUE TO NEAREST-NEIGHBOR CHARGE COMPENSATION. E. S. Kirkpatrick, K. A. Mueller, and R. S. Rubins (Battelle Memorial Inst., Geneva). Phys. Rev., 135: A86-90(July 6, 1964).

An axial electron paramagnetic resonance (EPR) spectrum in iron-doped (cubic) strontium titanate was observed at 3.3 and 1.85 cm wavelength with effective g values $g_\perp{}^e = 5.993 \pm 0.001$ and $g_\perp{}^e = 5.961 \pm 0.001$, respectively, and $g_{II}{}^e = g|| = 2.0054 \pm 0.0007$. The same spectrum was found after charge displacement due to heat treatment in the dark or by reduction in crystals which contained, in addition to iron, other transition metal ions. The spectrum is attributed to $\Delta M = 1$ transitions of the $S_z = \pm\frac{1}{2}$ level of $Fe^{3+}(3d^5)$ in a strongly tetragonal electric crystalline field produced by local charge compensation at a nearest-neighbor oxygen site. The theory is developed for ions of half-integral spin in an axial field much greater than the Zeeman splitting. By applying the theory to the special case of $S = \frac{5}{2}$ and using the measured effective $g_\perp{}^e$ values and resonance magnetic fields, $g_\perp = 2.0101 \pm 0.0008$, and a zero-field splitting parameter $|2D|$ of 2.85 ± 0.15 cm^{-1} is obtained. This is the largest splitting which has so far been observed for Fe^{3+} in any inorganic crystal and could be useful for submillimeter maser applications. (auth)

25410 F BAND IN ISOTOPICALLY ENRICHED LiF. Herbert Rabin and Michael Reich, (Naval Research Lab., Washington, D. C.). Phys. Rev., 135: A101-10(July 6, 1964).

The effect of isotopic composition on the optical absorption spectrum of the F center in LiF was investigated. The results of measurements on single crystals of x-ray irradiated Li^6F (almost 96% lithium 6) and Li^7F (almost 100%

lithium 7) indicate that the average F-band width at half maximum in the former is larger by about 3% at liquid-helium temperature, and by about 1% at room temperature. Theory shows that the half widths in the two isotopic forms vary inversely as the fourth root of the mass of the alkali ions at low temperature, and as the temperature is increased the predicted half-width difference monotonically decreases to zero. The predicted half-width difference at low temperatures is about 4%, and at room temperature about 1%, both in reasonable agreement with experiment. At both room and liquid-helium temperatures the position of the F-band maximum in Li^7F is slightly displaced to higher energy than in Li^6F. The peak-position shift is in approximate agreement with the contributions arising from the difference in alkali mass and lattice constant of the two crystals as estimated at low temperature. (auth)

25411 PARAMAGNETIC RESONANCE OF IRON GROUP ELEMENTS IN RUTILE. I. THE Ti^{47} AND Ti^{49} hfs INTERACTION. Eiso Yamaka and R. G. Barnes (Ames Lab., Ames, Iowa). Phys. Rev., 135: A144-8(July 6, 1964). (IS-555)

The well-resolved structure of the electron spin resonance (ESR) of V^{4+} and Mn^{4+} in rutile (TiO_2) is interpreted in terms of the hfs interaction of the ^{47}Ti and ^{49}Ti ions which occupy the nearest sites along the crystalline c axis. The absence of such structure in the cases of Cr^{3+} and Mn^{3+} is discussed in simple terms. (auth)

25412 ELECTRON SPIN DOUBLE RESONANCE STUDIES OF F CENTERS IN KCl. [PART] I. P. R. Moran (Cornell Univ., Ithaca, N. Y.). Phys. Rev., 135: A247-65(July 6, 1964).

The F-center electron-spin-resonance spectrum in KCl at 300°K was investigated using a double-frequency (DESR) technique. The F-center concentrations in the samples studied were $n_F \lesssim 3 \times 10^{17}$ cm^{-3}. A theoretical treatment of the response of the spin system to two simultaneously applied fields is developed. The T_1-T_2 spin-packet model of the F-center resonance is treated and a comparison of the experimental data with the theoretically predicted results indicates that this model cannot be used in a consistent interpretation. A general expression is derived which relates the DESR signal area to the absorption intensity in a corresponding ESR experiment. The application of this relation to the data gives a spin-lattice relaxation time at 300°K of $T_1 = 0.3 \times 10^{-4}$ sec with an estimated uncertainty of 15%. Significant contributions to the absorption intensity from "forbidden" transition processes were observed. These processes are attributed to a simultaneous electron and nuclear spin flip via the anisotropic terms in the hyperfine interaction. The large intensity associated with certain of these forbidden transitions implies a sufficiently rapid nuclear relaxation rate that the inhomogeneous broadening interactions may not be validly treated as a static phenomenon. (auth)

25413 NUCLEAR MAGNETIC RESONANCES OF ^{69}Ga AND ^{71}Ga IN GALLIUM-SUBSTITUTED YTTRIUM IRON GARNET. R. L. Streever and G. A. Uriano (National Bureau of Standards, Washington, D. C.). Phys. Rev. Letters, 12: 614-16(June 1, 1964).

The nuclear magnetic resonances of ^{69}Ga and ^{71}Ga in the mixed garnet system $3Y_2O_3 \cdot (5-x)Fe_2O_3 \cdot xGa_2O_3$ were studied. At 77°K the resonances were observed over a concentration range from x = 0.25 to x = 2.6, and at room temperature over a smaller concentration range. A phenomenological explanation of the results is attempted. (M.J.T.)

25414 ELECTRON-NUCLEAR DOUBLE RESONANCE STUDY AND EXCHANGE POLARIZATION OF THE SELF-TRAPPED HOLE IN LiF. Ramayana Gazzinelli and Robert Mieher (Columbia Univ., New York). Phys. Rev. Letters, 12: 644-7(June 8, 1964).

An Electron-Nuclear Double Resonance study of the self-trapped hole in LiF is reported. The study verifies a model of the self-trapped hole. The hyperfine constants of the Li and F nuclei in the lattice are measured, and provide an indication of the magnitude of the exchange polarization of closed electron shells at points distant from the lattice nuclei. (T.F.H.)

25415 A METHOD OF OBTAINING UNKNOWN JELLIES OF $Th^{4+}-PO_4^{3-}-H_2O$ SYSTEMS AND SOME OF THEIR PROPERTIES. Zdzislaw Sokalski and Piotr Szota (Silesian Inst. of Tech., Gliwice, Poland). Roczniki Chem., 38: 333-5(1964). (In Polish)

The basic components of simple and complex jelly systems are described. The kinetics of jelly formation and its mechanical properties were investigated. (auth)

25416 ELECTRON PARAMAGNETIC RESONANCE OF Gd^{3+} IN CaF_2. V. M. Vinokurov, M. M. Zaripov, Yu. E. Pol'skii, V. G. Stepanov, G. K. Chirkin, and L. Ya. Shekun (Kazan State Univ.). Soviet Phys.-Solid State (English Transl.), 5: 2126-9(Apr. 1964). (Translated from Fiz. Tverd. Tela, 5: 2902-7(Oct. 1963)).

The electron paramagnetic resonance (EPR) spectra of tetragonal and trigonal ^{3+}Gd complexes in the CaF_2 crystal lattice for H $\nparallel$ z were investigated. The $^4b_4$ constants for the tetragonal complex and the $^3b_4$ and $^3b_6$ constants for the trigonal complex were determined. The absolute sign of the spin-Hamiltonian constants was obtained from measurements at low temperatures. (auth)

25417 CALCULATION OF THE ELONGATION OF THE HYDROGEN BOND DURING ISOTOPIC SUBSTITUTION IN ICE. V. A. Savel'ev and N. D. Sokolov (Inst. of Chemical Physics, Academy of Sciences, USSR). Soviet Phys.-Solid State (English Transl.), 5: 2393-5(May 1964). Translated from Fiz. Tverd. Tela, 5: 3273-5(Nov. 1963).

The nature of the isotopic elongation of the O . . . O bond in ice is explained, and the dependence of the length of this bond on temperature in light and heavy ice is calculated. (auth)

25418 NEUTRON DIFFRACTION STUDY OF THE MAGNETIC ORDERING AND ATOMIC DISPLACEMENTS IN SOME PEROVSKITE LIKE SUBSTANCES CONTAINING IRON AND EXHIBITING PECULIAR DIELECTRIC PROPERTIES. S. V. Kiselev, A. N. Kshnyakina, R. P. Ozerov, and G. S. Zhdanov (Karpov Scientific Research Physics and Chemistry Inst., Moscow). Soviet Phys.-Solid State (English Transl.), 5: 2425-8(May 1964). Translated from Fiz. Tverd. Tela, 5: 3312-16(Nov. 1963).

Neutron diffraction studies were made of polycrystalline samples of the ferroelectric materials $BiFeO_3$ and $Pb(Fe_{\frac{1}{2}}W_{\frac{1}{2}})O_3$ at different temperatures as well as of two solid-solution samples in the system $BiFeO_3-LaFeO_3$, at room temperature. The nature and magnitudes of the atomic displacements were found for $BiFeO_3$ and the $BiFeO_3-LaFeO_3$ solid solutions. Data were obtained showing that $BiFeO_3$ belongs to the noncentrosymmetric space group R3m. It was found that the magnetic structures of $Pb(Fe_{\frac{1}{2}}W_{\frac{1}{2}})O_3$ and of the solid solutions in the system $BiFeO_3-LaFeO_3$ are of the G type. (auth)

25419 IRREGULARITY OF TRIBOLUMINESCENCE IN LITHIUM FLUORIDE CRYSTALS. L. M. Belyaev and

V. V. Nabatov (Inst. of Crystallography, Academy of Sciences, USSR). Soviet Phys.-Cryst. (English Transl.), 8: 744-5(May-June 1964). (Translated from Kristallografiya, 8: 927-8(Nov.-Dec. 1963).

The relation of cracking to emission was studied. Triboluminescence was excited by compressing crystals of pure lithium fluoride and by cleavage along cleavage planes. Consideration of the durations, shapes, occurrence, and rise and decay times of the light pulses as recorded by fast photomultipliers indicates that emission occurs while the crack is growing and that the emission is associated with a few special parts of the crack. (D.C.W.)

25420 GOLD AS A HEAT DISPERSANT IN EXOTHERMIC SOLID-GAS REACTIONS. APPLICATION TO THE OXIDATION OF URANIUM MONOCARBIDE POWDER. R. G. Sowden, N. Hodge, and M. J. Moreton-Smith (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Faraday Soc., 60: 759-62(Apr. 1964).

The oxidation of finely-divided uranium monocarbide in oxygen at low pressure was studied over the temperature range 140–230°C using gold powder to maintain isothermal conditions. The products of oxidation are $UO_{2.20}$ and free carbon: the reaction kinetics are consistent with a rate-determining step involving the diffusion of oxygen ions through a layer of oxide. (auth)

25421 STATISTICAL MODEL FOR NONSUBSTITUTIONAL SOLUTIONS. A. INTERSTITIAL SOLUTIONS. B. DEVIATION FROM STOICHIOMETRY IN INORGANIC COMPOUNDS. M. Hoch (Univ. of Cincinnati). Trans. Met. Soc. AIME, 230: 138-47(Feb. 1964).

Equations are derived from statistical considerations to represent the activities of each component of an interstitial solution, and of a compound with a wide homogeneity range as a function of composition and temperature, based on the interaction energies between the various components, E_{ij}. The equations are checked on the binary systems Fe–C, Ta–H, and Y–H, the ternary systems Ti–O–H, liquid Fe–C–O, and the compounds TiO, MnO, CoO, and YH_2. In all cases the present model represents the experimental data well. (auth)

25422 KINETICS OF ION EXCHANGE OF SULFOCATIONS. A. B. Sigodina, N. I. Nixolaev, and N. N. Tunitskii (Karpov Inst. of Physics and Chemistry, Moscow). Usp. Khim., 33: 439-61(Apr. 1964). (In Russian)

A review is given of generalized theoretical and experimental data on the kinetics of ion exchange in self-diffusion processes, diffusion of ion microcomponents, total exchange, large ion exchange on strongly acid cations, and the ratio between the diffusion and ionite electric conductivity. (82 references). (R.V.J.)

25423 REFLECTION SPECTRA OF LANTHANIDES IN THORIUM(IV) OXIDE AND THE LARGE NEPHELAUXETIC EFFECT OF OXIDE LIGANDS OR VACANCIES. Chr. Klixbuell Joergensen, Romano Pappalardo, and Elfriede Rittershaus (Cyanamid European Research Inst., Geneva). Z. Naturforsch., 19a: 424-33(Apr. 1964).

Retaining the cubic structure, ThO_2 can accommodate large concentrations of lanthanides and the equivalent amount of oxygen vacancies. The reflection spectra of Nd(III), Pr(III), Tb(III), Sm(III), Eu(III), Ho(III), Er(III), Tm(III), and Yb(III) were measured at 100°K in such samples. The excited J levels corresponded to rather broad bands in $Th_{1-x}M_xO_{2-0.5x}$ whereas Nd_2O_3 and Er_2O_3 had very detailed line groups. The visible spectra indicated a very large nephelauxetic effect in the oxide, with the nephelauxetic ratio β being smaller than in the aqua ion to the extent of 0.033 for Nd(III), 0.019 for Sm(III), 0.017 for Ho(III), 0.016 for Er(III), and 0.013 for Tm(III). These values were roughly five times larger than those for the anhydrous chlorides and were unexpected. (auth)

25424 KINETICS OF ISOTOPIC EXCHANGE REACTIONS. A REINVESTIGATION OF SYSTEMS INVOLVING IODINE ATOMS BY MEANS OF AN ELECTROCHEMICAL METHOD. Per Beronius (Royal Inst. of Tech., Stockholm). Z. Physik. Chem. (Frankfurt), 40: 33-50(Jan. 1964).

Rate data obtained in previous investigations using the electrochemical method seriously deviated from literature data. Therefore, to have an additional assessment of this method, a redetermination of the rates of the iodine exchange between two organic iodides and sodium iodide was undertaken in ethanol as solvent medium. The results obtained were only in rough agreement with data reported by other authors. For this reason the reactions were also followed using a conventional separation procedure for the reactants (evaporation). Velocity coefficients obtained by means of the two different methods of separation were in complete agreement. (auth)

25425 CHEMICAL SHIFTING OF THE ^7Li, ^{23}Na, AND ^{87}Rb RESONANCES BY THE PRESENCE OF PARAMAGNETIC IONS IN AQUEOUS SOLUTIONS. F. Fister and H. G. Hertz (Universität, Münster, Ger.). Z. Physik. Chem. (Frankfurt), 40: 253-60(Feb. 1964). (In German)

The chemical shiftings of the ^7Li, ^{23}Na, and ^{87}Rb nuclei possess, after deduction of a macroscopic susceptibility correction, negative values, the amounts of which increase in the series $Li^+ < Na^+ < Rb^+$. As a reason for the shifting, the contact exchange effect between the nucleus and the unpaired electrons of the paramagnetic ions. The results of the relaxation time measurements indicated that the distance between the interacting ions is proportionately large. (tr-auth)

25426 DISSOCIATION PRESSURE OF SAMARIUM, EUROPIUM, AND YTTERBIUM CHLORIDE. O. G. Polyachenok and G. I. Novikov (Leningrad State Univ.). Zh. Neorgan. Khim., 9: 773-7(Apr. 1964). (In Russian)

Dissociation reactions of trichlorides with separation of chlorine according to the equation $LnCl_3(l) \rightleftharpoons LnCl_2(l) + \frac{1}{2}Cl_2$ (where Ln is the rare earth) were studied in order to determine the chlorine pressure over $SmCl_3$, $EuCl_3$, and $YbCl_3$ at over 1000°C. A quartz membrane zero manometer was used to measure the dissociation constant of molten $SmCl_3$, $EuCl_3$, and $YbCl_3$. The data obtained were used for determining the thermal capacity and entropy of formation of samarium, europium, and ytterbium di- and trichlorides. (R.V.J.)

25427 REDUCTION OF ANHYDROUS YTTRIUM AND RARE EARTH SULFATES BY CARBON MONOXIDE. V. P. Surgutskii and V. V. Serebrennikov (Tomsk State Univ., USSR). Zh. Neorgan. Khim., 9: 786-8(Apr. 1964). (In Russian)

The behavior of anhydrous rare earth sulfates in carbon monoxide was studied at 500 to 800°C. Oxysulfides Ln_2O_2S (where Ln is a rare earth) were prepared by the reduction of rare earth (La, Pr, Nd, Sm, Gd, Tb, and Dy) and yttrium sulfates by carbon monoxide. Thermographic studies of the temperature of the rare earth reduction by carbon monoxide indicated a general tendency to reduced temperature from La to Ga and further increase from lanthanides to lutetium. Anomalous low temperatures were noticed for carbon monoxide reduction of cerium, praseodymium, samarium, and europium sulfates which exhibited an alternating valency. (R.V.J.)

25428 MICROCOULOMETRIC INVESTIGATION OF REDUCTION OF URANYL CARBONATE COMPLEXES. E. A. Kanevskii and G. R. Pavlovskaya. Zh. Neorgan. Khim., 9: 827-30(Apr. 1964). (In Russian)

A microcoulometric determination of the electron number Z for the polarographic reduction of U(VI) in 5 and 50 g/l Na_2CO_3 and $NaHCO_3$ solutions showed reduction to U(V) in Na_2CO_3 solution and a step-by-step reduction to U(IV) in $NaHCO_3$ solution; moreover, each step corresponded to a one-electron transition. The data obtained on the magnitude of Z were correlated with polarographic data, and the irreversible character of the reduction of U(VI) in carbonate solutions was verified. (R.V.J.)

25429 SALTS OF DIALKYL PHOSPHORIC ACIDS. V. A. Mikhailov and E. F. Grigor'eva (Inst. of Inorganic Chemistry, Academy of Sciences, Siberian SSR). Zh. Neorgan. Khim., 9: 867-75(Apr. 1964). (In Russian)

The preparation, classification, and physicochemical properties of Ag, Cd, Co, Cu, Fe, La, Ni, Pb, Th, UO_2, Zn, and ZrO metal salts synthesized with dimethyl, diethyl-di-n-propyl-, di-n-butyl-, di-n-amyl phosphoric acids were studied. In benzene solutions at the temperature of boiling benzene the Ag, Zn, Cd, Pb, Ni, Co, and Cu dibutyl phosphates are monomeric, and at low temperature a reversible polymerization takes place. (R.V.J.)

25430 LANTHANUM TELLURIDES. A. A. Eliseev, E. I. Yarembash, V. G. Kuznetzov, E. S. Vigileva, A. A. Reshchikova, and L. I. Antonova (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zh. Neorgan. Khim., 9: 876-82(Apr. 1964). (In Russian)

Differential-thermal analysis showed that at a 10°/min rate of heating the reaction between La and Te begins at 360°C. Below the liquidus curve, at from 50 to 80 at.% Te, in addition to LaTe, the mixture formed La_3Te_4, La_4Te_7, $LaTe_2$, and $LaTe_3$. The telluride-lanthanum sesquimixture (La_3Te_4) crystallized into Th_3P_4 lattice with the parameter $a = 9.6000 \pm 0.0005$ kX. The structures of the lanthanum tellurides, La_4Te_7 (or La_7Te_{12}) and $LaTe_2$ are almost identical. Lanthanum ditelluride ($LaTe_2$) crystallized into a tetragonal lattice with parameters $a = 4.547 \pm 0.003$ kX and $c = 9.158 \pm 0.006$ kX. Lanthanum tritelluride ($LaTe_3$) is gold-brown in color and dissociates on heating in a vacuum as follows: $LaTe_3 \xrightleftharpoons{>460°} LaTe_{2+x} + (1-x)$ Te. The electric conductivity and thermal electromotive force of lanthanum tellurides were studied as functions of the composition. (R.V.J.)

25431 REACTIONS OF BERYLLIUM AND ALUMINUM CHLORIDE ETHERATES. N. Ya. Turova, N. S. Kedrova, K. N. Semenenko, and A. V. Novoselova (Moscow State Univ.). Zh. Neorgan. Khim., 9: 905-16(Apr. 1964). (In Russian)

Physicochemical studies were made of reactions of Be and Al chloride etherates in melts and in ether and benzene solutions. The solubilities of $AlCl_3 \cdot (C_2H_5)_2O$–ether, $BeCl_2 \cdot 2(C_2H_5)_2O$–$AlCl_3 \cdot (C_2H_5)_2O$, $BeCl_2 \cdot 2(C_2H_5)_2O$–$AlCl_3 \cdot (C_2H_5)_2O$–ether, $BeCl_2 \cdot 2(C_2H_5)_2O$–$AlCl_3 \cdot (C_2H_5)_2O$–benzene were determined. It was found that $BeCl_2 \cdot AlCl_3 \cdot 3(C_2H_5)_2O$ melts congruently at 55°. Beryllium and aluminum chloride etherates form a one molar constituent complex. A system consisting of beryllium and aluminum chloride etherates and benzene exhibits stratification inside the ternary system at 20°C. (R.V.J.)

25432 ELECTRIC CONDUCTIVITY OF OXIDE-FLUORIDE MELTS OF POTASSIUM, ZIRCONIUM, AND BORON. P. A. Polishchuk. Zh. Neorgan. Khim., 9: 921-4(Apr. 1964). (In Russian)

Electric conductivity of the $KF-KB_4-3K_2ZrF_6/2B_2O_3$ system was studied and correlated to the melt diagram. The dependence of electric conductivity on temperature indicates an ionic type of structure. An increase in KF content increased the electric conductivity of the system. (R.V.J.)

25433 PREPARATION OF LANTHANUM SILICATES. T. V. Permyakova and I. S. Lileev (Inst. of Chemistry of Silicates, Academy of Sciences, USSR). Zh. Neorgan. Khim., 9: 925-30(Apr. 1964). (In Russian)

The preparation of lanthanum silicates at low temperatures by the exchange reaction between lanthanum sulfate and sodium silicate was investigated, and some chemical properties of lanthanum silicates were determined. An exchange reaction at 1 : 3 ratio between lanthanum silicate and sodium sulfate produced lanthanum pyrosilicate; with 1 : 1 and 1 : 2 ratio, it produced lanthanum oxyorthosilicates. The lanthanum silicate is formed at 900 to 1000°. It was also found that water and sodium hydroxide do not influence lanthanum silicates but it is easily decomposed by an acid. The preparation of pure lanthanum silicate was achieved by treating the sintered material with sodium hydroxide followed by water elution. (R.V.J.)

25434 YTTRIUM AND GADOLINIUM OR LANTHANUM NITRATE SYSTEMS. F. M. Perel'man and I. Z. Babievskaya (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zh. Neorgan. Khim., 9: 986-90(Apr. 1964). (In Russian)

Solubility and solid phase compositions in the systems $Y(NO_3)_3-Gd(NO_3)_3-HNO_3-H_2O$ and $Y(NO_3)_3-La(NO_3)_3-HNO_3-H_2O$ was studied at 25 ± 0.1° and at HNO_3 concentrations of 30 to 35%. Under these conditions, yttrium nitrate crystallized with four water molecules. The solubility of yttrium and lanthanum nitrates (HNO_3 = 32.8 to 32.9%) is 26.6 and 30.0% and of yttrium and gadolinium (HNO_3 = 31.8 to 32.0%) 28.3 to 26.1%, respectively. In nitric acid yttrium nitrate with gadolinium nitrate formed a gadolinium-enriched continuous series of solid solutions while with lanthanum nitrate it did not form either solid or chemical compounds and was of a simple eutonic character. The eutonic solution crystallized into two solid phases: $Y(NO_3)_3-4H_2O$ and $La(NO_3)_3 \cdot 6H_2O$ with concentration of $La(NO_3)_3$ = 22.3% and $Y(NO_3)_3$ = 15.25%. (R.V.J.)

25435 PRESSURE AND COMPOSITION OF THE VAPOR IN POTASSIUM CHLORIDE SYSTEMS WITH SAMARIUM, YTTERBIUM, CALCIUM AND STRONTIUM DICHLORIDES. S. A. Frid, O. G. Polyachenok, and G. I. Novikov (Leningrad State Univ.). Zh. Neorgan. Khim., 9: 1017-19(Apr. 1964). (In Russian)

Saturation vapor pressure in $KCl-SmCl_2$, $KCl-YbCl_2$, $KCl-CaCl_2$, and $KCl-SrCl_2$ systems was measured at 1050 to 1150°C over melts containing 25, 50, and 75 mole % KCl. (R.V.J.)

25436 VAPOR PRESSURE OF TRITIUM OXIDE. M. M. Popov and F. I. Tazetdinov. Moscow, 16p. of "Glavnoye Upravleniye po Ispol'zovaniyu Atomnoi Energii, Pri Sovete Ministrov SSSR," 1960.

New experimental data on the vapor pressure of highly concentrated T_2O are presented. Measurements of vapor pressure in the 12 to 95°C range were carried out by the usual static method modified to take into account the pressure of the products of radiolysis and nuclear reactions. The apparatus employed is described, and a sketch is given. Samples were measured in microquantities containing 83.4 to 98.1 mole % T_2O. Experimental and calculated data were found to be in satisfactory agreement.

The accuracy of measurement was shown to be sufficient to detect the difference in vapor pressures between T_2O and other isotopic modifications of water. The difference in vapor pressure between T_2O and D_2O was small; the vapor pressure of T_2O was somewhat lower than those of D_2O or H_2O. The vapor pressure of tritiated water, HTO, calculated from vapor pressures and heats of vaporization data for H_2O and T_2O, was higher than those of either D_2O and T_2O. The heats of vaporization of HTO and D_2O are nearly identical. The vapor pressure ratios H_2O/T_2O and D_2O/T_2O approach 1 as the temperature is increased. The boiling points, heats of vaporization, and standard entropies of HTO and T_2O were derived from the experimental vapor pressure data. (A.I.D. Press, Vol. 2, No. 234, May 1964)

25437 ANALYSIS OF THE SPECTRA OF PLANAR ASYMMETRIC MOLECULES WITH APPLICATION TO HYDROGEN SELENIDE. Ronald Ames Hill. Thesis, East Lansing, Mich., Michigan State Univ., 1963. 198p.

Specific analytical expressions for the centrifugal distortion energy, and for the sum rules, are derived for the planar asymmetric molecule in terms of the four centrifugal distortion constants τ_{aaaa}, τ_{bbbb}, τ_{aabb}, and τ_{abab}. These equations are applied in a least squares analysis, by digital computer, of the ground state combination differences of the near infrared absorption bands $2\nu_1$, $\nu_1 + \nu_3$, $2\nu_1 + \nu_2$, and $\nu_1 + \nu_2 + \nu_3$ for $H_2{}^{80}Se$ and $H_2{}^{78}Se$. Due to a Coriolis interaction between the states $2\nu_1$ and $\nu_1 + \nu_3$ and between the states $2\nu_1 + \nu_2$ and $\nu_1 + \nu_2 + \nu_3$, the first order energy expression is not able to fit either set of upper state rotational energy levels. However, certain combinations of the upper state molecular constants, and the band centers were obtained for $2\nu_1$, and $\nu_1 + \nu_3$ through the use of coupled sum rules for the interacting submatrices, E^+ with E^- and O^+ with O^- for the two states. The analysis of the two states was completed, and a value of the perturbation coefficient G_c was calculated, through the diagonalization of three, 2 by 2, coupled sub-matrices. Band center separations for the various isotopic species, $H_2{}^{80}Se - H_2{}^{82}Se$, $H_2{}^{78}Se - H_2{}^{80}Se$, $H_2{}^{77}Se - H_2{}^{80}Se$, and $H_2{}^{76}Se - H_2{}^{80}Se$ are obtained from the spectra for these four absorption bands. (Dissertation Abstr.)

25438 CARBONATE AND BICARBONATE COMPLEXES OF NEODYMIUM AND EUROPIUM. Howard S. Sherry. Thesis, Buffalo, New York State Univ., 1963. 97p.

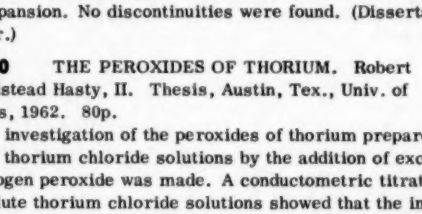
The distribution of Eu (III) and Nd (III) between Dowex I-X8 and solutions of $KHCO_3$ and K_2CO_3 was studied as a function of salt concentration in order to elucidate their complexing behavior in the presence of these inorganic ligands. Equilibration and chromatographic techniques were employed using radioactive isotopes of Eu and Nd to facilitate the investigation. The distribution of tracer ^{35}S in the form of $^{35}SO_4^{2-}$ between Dowex I-X8 and solutions of $KHCO_3$ and K_2CO_3 was studied to determine the effect of imbibed electrolyte and changing internal and external activity coefficients. Analysis of the data indicates that imbibement and activity coefficient corrections are negligible over the concentration range that is covered, thus giving an experimental basis for the theoretical treatment of the data. Distribution coefficients were measured over the concentration range of 0.0010 to 1.00 molal K_2CO_3 and $KHCO_3$. Over this region a logarithmic plot of the distribution coefficient versus the logarithm of salt molality ($KHCO_3$ or K_2CO_3) resulted in curves which were analyzed for the complex species that exist in solution, their stepwise formation constants, and their relative concentrations (ion fractions). Computer methods were used to facilitate these calculations. Analysis of the $KHCO_3$ systems indicates the presence of the di-, tetra-, penta-, and heptabicarbonato complexes. A similar analysis of the K_2CO_3 systems indicates the presence of the dicarbonato, tricarbonato and tetracarbonato-hydroxo complexes. (Dissertation Abstr.)

25439 SOME THERMODYNAMIC PROPERTIES OF LIQUID HELIUM THREE BELOW 1.0° ABSOLUTE. John Edgar Rives. Thesis, Durham, N. C., Duke Univ., 1962. 108p.

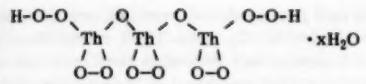
The density of liquid ^3He was measured between 0.045 and 1.3°K at pressures up to 28.0 atm. Above about 15 atm an unexpected minimum in the density was found to occur, the temperature of this minimum increasing to 0.09° as the pressure was increased to 28.0 atm. At a pressure of 0.18 atm, below 0.09°K, the coefficient of expansion was found to be proportional to the absolute temperature. The method used in this experiment consisted of measuring the dielectric constant of the liquid with a parallel resonant LC circuit. The liquid was contained in the cylindrical capacitor. The density was then obtained using the Clausius-Mosotti relation. The liquid density was also found to go through a maximum value at a temperature which increased with pressure, from 0.5°K at saturated vapor pressure to about 1.2°K at 28.0 atm, in good agreement with earlier investigations. For pressures above 15 atm, the coefficient of expansion was, of course, positive for temperatures below the density minimum. Using the calculated values of the density and the coefficient of expansion, the entropy of compression was calculated at various temperatures between 0.05 and 0.8°K. The existence of the density minimum implies that the entropy of compression must pass through a maximum value. No evidence of the theoretically predicted superfluid transition was found. The predicted second order transition would produce a discontinuity in the coefficient of expansion. No discontinuities were found. (Dissertation Abstr.)

25440 THE PEROXIDES OF THORIUM. Robert Armistead Hasty, II. Thesis, Austin, Tex., Univ. of Texas, 1962. 80p.

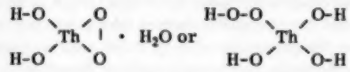
An investigation of the peroxides of thorium prepared from thorium chloride solutions by the addition of excess hydrogen peroxide was made. A conductometric titration of dilute thorium chloride solutions showed that the initial product contained five peroxide groups per three thorium atoms. Further studies showed that the composition of the initial product was only slightly affected by the composition of the precipitating solution. The variable amount of the anion present in the initial product, in the case of the chloride ion, was found to be dependent upon the washing of the initial product. It was shown that the peroxide groups did not hydrolyze during the washing of the initial product. Studies of the decomposition of the initial product revealed that the stability of the material was dependent on the amount of water present in the wet precipitate. The formulation of the initial product was proposed to be either



or



The dried product, obtained by dehydration of the initial product at room temperature, contained one peroxide group per thorium atom, two water molecules per thorium atom, and the same chloride-to-thorium ratio as in the initial product. Isotopic exchange studies of the dried product with oxygen 18-enriched deuterium oxide indicated the formulation of the dried product to be either



A thermogravimetric study of the dried product indicated that decomposition occurred at approximately 40°C. (Dissertation Abstr.)

25441 RADIOCHLORINE EXCHANGE ON OXYCHLORIDE SYSTEMS. David Lee Lydy. Thesis, Urbana, Ill., Univ. of Illinois, 1963. 146p.

The radiochlorine exchange reactions between tetraethylammonium chloride and labelled phosphorus oxychloride, dichlorophenylphosphine oxide, and thiophosphoryl chloride have been investigated in the solvent ethylene dichloride. The exchange reactions were found to be first order in each of the reactant species at −30°. The rate of exchange for the three phosphoryl chlorides varied in the following manner: $C_6H_5POCl_2 > POCl_3 > PSCl_3$. This is the order that would be predicted from a consideration of the electronic effects in the ground and transition states. The mechanism of the exchange is thought to involve the nucleophilic attack of a chloride ion on the phosphorus atom giving an sp^3d hybridized trigonal bipyramidal transition state. The rehybridization of the phosphorus orbitals in the transition state would result in an increased electronegativity for the phosphorus atom. Electron donating substituents bonded to the phosphorus atom would, therefore, be expected to stabilize the transition state. The relative rates of the dichlorophenylphosphine oxide and phosphorus oxychloride exchange reactions may thus be explained by the electron donating ability of the phenyl group. The slower rate of exchange observed for thiophosphoryl chloride has been proposed to be due to the larger polarizability of the sulfur atom and to the smaller degree of multiple bond character in the thiophosphoryl linkage. Both of these effects would result in less stabilization of the transition state relative to the ground state for the thiophosphoryl compound than for the phosphoryl compounds. The activation energies determined for the three phosphoryl chlorides were in agreement with the order of reactivity predicted by an electronic consideration of the ground and transition states. Complete exchange within the minimum time of separation has been observed between tetraethylammonium chloride and methyl sulfinyl chloride both in the pure liquid and in acetonitrile and ethylene dichloride solvents. (Dissertation Abstr.)

25442 THE PREFERENTIAL ADSORPTION AND HETEROGENEOUS SPIN CONVERSION OF ORTHO-HYDROGEN AND PARA-DEUTERIUM ON ALUMINA AT 20.4°K. James Gettins Eberhart. Thesis, Columbus, Ohio Ohio State Univ., 1963. 123p.

When hydrogen or deuterium is adsorbed on a suitable solid surface at low temperatures it is found that the molecules in the J = 1 rotation state are adsorbed more strongly than those in the J = 0. Two experiments were described by which separation factors for the preferential adsorption of ortho-hydrogen and para-deuterium on γ-alumina are determined at 20.4°K. In the first experiment hydrogen or deuterium gas was passed through a bed of γ-alumina adsorbent at a pressure corresponding to one monolayer. After the gas equilibrated with the γ-alumina it was desorbed and the ortho-para composition of the gas was determined at various stages of desorption. If the separation factor is calculated from the composition of the last desorbed gas and the feed gas, values of 8.8 and 3.2 are obtained for hydrogen and deuterium, respectively, at 20.4°K. In the second experiment the heterogeneous spin conversion of ortho-hydrogen and para-deuterium in the liquid phase was studied at 20.4°K, using four chromia impregnated γ-alumina catalysts. The variation of the liquid phase ortho-para composition with time was explained by assuming that the conversion occurs in the first adsorbed layer, that there is preferential adsorption of ortho-hydrogen or para-deuterium, and that the conversion is first order in the mole fraction of ortho-hydrogen or para-deuterium in the adsorbed phase. Rate constants, k, ranged from 0.0031 to 0.057 min^{-1} for H_2 and 0.0026 to 0.022 min^{-1} for D_2 for 1 mole of liquid and 25 gm of catalyst. The separation factors, S, ranged from 15 to 21 for H_2 and 7 to 9 for D_2, except for the fastest H_2 conversion where S was 35 ± 20. Within experimental error it was found that k and S were related on all catalysts according to the equation $(k/S)_{H_2} = 0.62\ (k/S)_{D_2}$, which can be developed from time-dependent perturbation theory considerations. The separation factors obtained from both experiments were interpreted by assuming that the adsorbed molecule is a rigid rotator whose motion is hindered by an independent interaction potential between each of the two atoms and an adsorbent surface having a certain geometry. The separation factors obtained from the monolayer adsorption experiments represent an average surface site on a pure γ-alumina adsorbent. If most of the sites on the surface have a planar geometry and if θ is the angle the axis of the molecule makes with a normal to the surface, then a potential function depending on $\cos^2\theta$ results, which has a minimum when the molecular axis is parallel to the surface. Heterogeneous spin conversion, however, only occurs on the special active sites having an impregnated paramagnetic chromic ion. These ions are probably located in surface holes which can be approximated by a long cylinder. Such a geometry results in a potential depending on $\sin^2\theta$, which has a minimum when the axis of the molecule coincides with the axis of the cylinder. (Dissertation Abstr.)

25443 POLAROGRAPHY OF HYDROGEN PEROXIDE IN LANTHANUM SOLUTIONS. Mary Tashdjian Henne. Thesis. Columbus, Ohio, Ohio State Univ., 1963. 145p.

The reduction of hydrogen peroxide at the dropping mercury electrode in neutral, unbuffered lanthanum solutions was studied by conventional polarography and oscillography under standardized procedures covering the preparation and age of the test solutions and their deaeration in the absence of mercury. Nitrates were chosen as supporting electrolytes in preference to perchlorates and chlorides. The reduction is characterized by a sharp positive maximum at +0.2 v vs. S.C.E., followed by a minimum current and a second wave which rises at a potential more positive than that of the usual single wave at −0.6 v in sodium nitrate. At concentrations ranging from 50 to 1 m$\underline{M}$ $La(NO_3)_3$ and 0.4 to 12.2 m$\underline{M}$ H_2O_2, the second wave shifted to more negative potentials with the lanthanum nitrate concentration and to more positive potentials with the hydrogen peroxide concentration. The limiting current of the second wave and the peak current of the positive

maximum rose linearly with the hydrogen peroxide concentration. Experiments at greater dilution established the requirement of better than minimal amounts of hydrogen peroxide, lanthanum, and nitrate ions for appearance of the positive maximum. Experiments in the presence of an excess of ammonium nitrate or with zinc substituted for lanthanum established that the La^{+3} effect was not merely due to acidity but was related to lanthanum hydroxide specifically. With increasing amounts of lanthanum hydroxide supplied to the text solutions, the pH rose from 7 to 8, the limiting current of the second wave gradually decreased and the minimum current increased. Ultimately, the polarogram showed only a single reduction current, smaller than 0.5 μa, starting at +0.2 v, rising linearly, and limited at −0.8 v by the nitrate reduction wave. An aliquot treated with permanganate showed only a current identical to the residual current of the untreated solution; another aliquot, acidified to pH 3, showed only a conventional hydrogen peroxide wave at −0.8 v instead of the small linear current. It was concluded that in basic solutions a lanthanum peroxy-compound, designated as L.P.C., was formed, which was reducible at +0.2 v, the potential of the positive maximum. L.P.C. is soluble, oxidizes mercury only negligibly and its reduction current is rate controlled; its formation requires minimal amounts of H_2O_2, $La(OH)_3$, and $La(NO_3)_3$; it is regarded as the peroxy-cation of a polynuclear basic complex with formulation such as $La[La(OH)_3]HO_2^{+2}$ or $[La_2OH_2]HO_2^{+3}$. In solutions 50 mM or less in lanthanum nitrate, there is no peroxide prior to contact with mercury. Therefore, when L.P.C. is involved it is likely to be due to interaction between available hydrogen and lanthanum hydroxide generated at the electrode. On mere contact, even without applied potential, mercury and a solution containing H_2O_2 and $La(NO_3)_3$ interact chemically to liberate oxygen and to generate mercuric ions and an L.P.C. equivalent peroxide, both reducible at +0.2 v. Consequently, to be valid polarographic measurements must be made within ten minutes after establishing contact. The oscillographic studies were made with a sixteen second drop time capillary. A set potential was applied at the start of the first recorded drop and the amplified current was viewed during the growth of successive drops. After stirring, a new set of drops was recorded at a new, more negative potential. The characteristics were these: (1) the first drop differs from its successors; (2) the curves taken at the positive maximum and at the second wave are similar, and the first drop offers a maximum; (3) the curves at the polarographic minimum differ and present a striking time delay. They were assigned to the catalytic reduction of hydrogen peroxide through L.P.C. intermediates and to the preferential adsorption of the basic lanthanum complexes in the +0.1 v to −0.1 v range. (Dissertation Abstr.)

25444 NEW PHASES IN THE TANTALUM–TUNGSTEN–OXYGEN SYSTEM. Barry Arnold Noval. Thesis, Brooklyn, Polytechnic Inst. of Brooklyn, 1963. 90p.

Ta_2O_5 and WO_3 were reacted at 1000°C and 1200°C in vacuo and in the presence of 6 cm of O_2. When heated in evacuated sealed quartz tubes, the tubes were observed to be expanded and the products were deep blue in color indicating oxygen evolution and the formation of a lower oxide of tungsten. An x-ray diffractometer study of the products revealed two new phases, as well as terminal solid solutions of the parent oxides. For reactions carried out at 1200°C, the existence of solid solutions of up to 4% Ta_2O_5 in monoclinic WO_3 and to 13% WO_3 in monoclinic Ta_2O_5 was discovered. A new tetragonal phase had a region of homogeneity of about 25 to 35 mole % Ta_2O_5 while another new phase indexed on an orthorhombic unit cell was found at 54% Ta_2O_5. A 2% Ta_2O_5 composition, a solid solution in monoclinic WO_3 when examined in a high temperature goniometer was found to undergo transitions at 325 and 745°C, approximating those for undoped WO_3. A single crystal Weissenberg study showed the tetragonal phase to be a superlattice of $K_{0.57}WO_3$ with $a = 3\,a_0 = 36.76$ Å, $b = 3\,b_0 = 36.76$ Å and $c = c_0 = 3.887$ Å. X-ray diffraction of powders revealed only an ordering of the "a" axis. A structure factor calculation was made based on the small tetragonal cell and using the values for the atomic coordinates as given by Magnéli. An R value of 33.6 was obtained for Magnéli's values which was reduced to 28.72 when the parameter 0.080, 0.186 was employed for W_{II}. The relatively large magnitude of R indicated structural differences for the Ta_2O_5–WO_3 material. The orthorhombic phase is possibly a distorted perovskite structure and has the dimensions a = 8.804 Å, b = 7.719 Å, c = 16,607 Å. High temperature diffractometry shows this phase to be very stable with only a slight variation in lattice constants up to 1200°C. Conductivity measurements on pressed pellets revealed two linear regions with positive temperature coefficients of conductivity and indicated these preparations to be poor conductors with $\sigma_0 \sim 10^{-5}$ ohm^{-1} cm^{-1}. The activation energies are only of the order of 0.05 ev. There are about 10^{17} to 10^{18} carriers/cm^3 having a mobility of 10^{-4} cm^2/volt-sec for 10^{17} carriers, and 10^{-3} cm^2/volt-sec for 10^{18} carriers. Thermoelectric power measurements show the carriers to be electrons, which are probably ionized from O_2 vacancies. The low mobilities and activation energies indicate a hopping mechanism for conduction. Measurements of oxygen pressure for reactants heated in vacuo set an upper limit to the oxygen deficiency giving for a 30% Ta_2O_5 composition, the formula $W_{0.548}Ta_{0.535}O_{2.982}$. The experimental density is 7.1 in agreement with Ta occupying alkali metal positions as well as substituting for W octahedrally. The results indicate that the introduction of Ta in monoclinic WO_3 does not bring about a room temperature ferroelectric phase in accordance with the lowering of the Curie point as implied by Levine. Two new phases were uncovered. One of these is a 3×3 superlattice of a $K_{0.57}WO_3$ material with some undetermined differences in atomic coordinates. The other new phase is orthorhombic and is quite stable at temperatures up to 1500°C. The electrical properties of pressed pellets of these materials have been examined from room temperature to 200°C. (Dissertation Abstr.)

25445 EUROPIUM CHELATES AS LASER MATERIALS. A. Lempicki, H. Samelson, and C. Brecher (General Telephone and Electronics Labs., Inc., Bayside, N. Y.). 12p. (CONF-405-19)

From 4th Rare Earth Research Conference, Phoenix, Ariz., Apr. 1964.

An investigation of the differences between the properties of EuB chelate and related compounds showed that rather stringent requirements must be met by the energy transfer processes in order to achieve laser action. Trapping effects, revealed by even small amounts of organic phosphorescence, are particularly detrimental. The very high absorption constant of EuB is responsible for the high threshold of this material and its consequent low efficiency as a laser. On the other hand, the radical changes that can be produced by chemical substitution show that intelligent manipulation of the properties may become possible once the basic processes are well understood. (auth)

25446 THE DIFFERENTIAL THERMAL ANALYSIS OF BASIC RARE EARTH AZIDES. H. Rosenwasser and

O. F. Kezer (Army Engineer Research and Development Labs., Fort Belvoir, Va.). 21p. (CONF-405-30)

From 4th Rare Earth Research Conference, Phoenix, Ariz., Apr. 1964.

Thermal decomposition of the basic rare earth azides involves loss of water and loss of nitrogen. Break-up of the azido group(s) probably goes through an oxyazide intermediate stage before the final oxide formation. Simultaneous dehydroxylation of the basic rare earth azide (BREA), causing an endothermal dip in the exothermal line shape of the DTA thermograms, presumably leads to formation of the oxyhydroxide. The BREA may undergo a slow non-explosive decomposition or a more violent rapid decomposition depending upon heating rate, atmospheric environment, sample size, and other factors. As expected, the BREA containing the lighter elements La through Dy, with their higher azide content, are more apt to show the sharp exotherm characteristics of a fast reaction. (P.C.H.)

25447 PREPARATION OF SILICATE HYDROSOLS. (to W. R. Grace and Co.). British Patent 955,117. Apr. 15, 1964. Priority date May 12, 1960, United States.

A process is given for preparing metal orthosilicate sols, particularly thorium silicate sols for use as fuel in aqueous homogeneous reactors. The process comprises hydrolyzing together at high temperatures a thorium salt with a strong inorganic monobasic acid and an organic silicate. The hydrolysis may be effected by electrodialysis, urea hydrolysis, or hydrodlysis in aqueous solutions. Several examples of the process are given. (D.L.C.)

25448 METHOD FOR THE PREPARATION OF ANHYDROUS URANIUM TETRAFLUORIDE. Chuko Ito, Takeo Okuda, and Yumi Akimoto (to Misubishi Kinzoku Kogyo Kabushiki Kaisha). German Patent 1,163,788. Feb. 27, 1964. Priority date Jan. 8, 1958, Japan.

Anhydrous uranium tetrafluoride of high purity is prepared from uranium(IV)-containing watery solutions by the steps of reducing electrolytically a uranyl sulfate solution obtained by acidifying the base solution with sulphuric acid, extracting uranium(IV) with a 1 molar solution of di-2-ethylhexyl phosphoric acid in paraffin, adding hydrofluoric acid to the extract, and filtering and drying the uranium tetrafluoride. (Gmelin Inst.)

Organic Chemistry

Refer to abstract 25061.

25449 (Y-1470-D) X-RAY FLUORESCENCE TABLES: ETHYLENEDIAMINE DEXTROTARTRATE (EDDT) CRYSTAL. W. P. Amsbury, W. W. Lee, J. H. Rowan, and G. E. Walden (Union Carbide Corp. Nuclear Div. Y-12 Plant, Oak Ridge, Tenn.). Apr. 24, 1964. Contract W-7405-eng-26. 171p.

A critical compilation of standard reference tables of x-ray fluorescence lines was published in convenient form for experimental use. This section of the report contains tables calculated for an ethylenediamine dextrotartrate (EDDT) crystal. (auth)

25450 APPLICATION OF THE ^{239}Pu ELECTRODE TO MEASUREMENTS OF ELECTRIC SURFACE POTENTIALS OF AQUEOUS SOLUTIONS OF ORGANIC BASES. J. Pawelek (Inst. of Physical Chemistry, Krakow). Electrochim. Acta, 9: 531-2(May 1964).

The electric surface potential of 2-methyl-2-propylpropandiol-1,3-dicarbamate, pentamethylentetrazol, and N-methyl-1,5,6-tetrahydropyridine-3-carboxylic acid methyl ester solutions in 0.1N potassium chloride was measured at different pH values. The dynamic jet method and the radioactive electrode method with ^{239}Pu (half life period 2.4×10^4 y) were used. Both give similar potential changes, except that the radioactive electrode gives somewhat higher results at low concentrations. (auth)

25451 FLUOROCARBANIONS. RATES OF BASE-CATALYZED HYDROGEN–DEUTERIUM EXCHANGE, ISOTOPE EFFECTS, AND ACIDITY OF MONOHYDROFLUOROCARBONS. S. Andreades (E. I. du Pont de Nemours and Co., Wilmington, Del.). J. Am. Chem. Soc., 86: 2003-10(May 20, 1964).

The formation of perfluorocarbanions from monohydrofluorocarbons bearing H in primary, secondary, and tertiary positions was demonstrated by isotopic exchange in sodium methoxide–methanol solution. The kinetics of exchange measured by ^{19}F nmr, infrared, and mass spectral techniques give relative reactivities of 1.0, 6, 2×10^5, and 10^9 for fluoroform, 1-H-pentadecafluoroheptane, 2-H-heptafluoropropane, and tris(trifluoromethyl) methane, respectively. Heptafluoro-n-propyl and heptafluoroisopropyl carbanions, in the form of lithio derivatives generated from the corresponding monohydrofluorocarbons, were trapped by reaction with propionaldehyde. The solvent isotope effect for labeled methanol, (k_{CH_3OD}/k_{CH_3OH}) = 1.5, was determined using rates of tritium exchange for the primary system. Activation parameters and solvent-corrected deuterium isotope effects are reported and used in a discussion of the mechanism of exchange and the acidity of monohydrofluorocarbons. (auth)

25452 HIGH FREQUENCY TITRIMETRIC DETERMINATION OF THE ELECTRON DEFICIENCY IN LITHIUM ALKYLS. Frank A. Settle, Maureen Haggerty, and Jerome F. Eastham (Univ. of Tennessee, Knoxville). J. Am. Chem. Soc., 86: 2076-7(May 20, 1964). (TID-20492)

Measurements were made on the changes in dielectric properties of several Li alkyls consequent to their titration with Lewis bases. Although an RLi solution in hexane is hardly more polar than hexane alone, it was found that addition of ether causes a relatively steep rise in the dielectric character of the solution, (more change in the dielectric than ether alone causes) and that the rise is complete when the ratio of RLi to Et_2O is 2 :1. High frequency titrations of butyllithium in hexane were also carried out with triethylamine (Et_3N) instead of Et_2O as the base. Et_3N also caused a rise in dielectric character, and the steep rise was complete with the addition of one pair of nonbonding electrons from the base for every R_2Li_2 unit in solution. (P.C.H.)

25453 NUCLEAR HYDROGEN–DEUTERIUM EXCHANGE IN RESORCINOLS AND RELATED COMPOUNDS IN WEAKLY ALKALINE SOLUTION. Elli Smakula Hand and Robert M. Horowitz (Dept. of Agriculture, Pasadena, Calif.). J. Am. Chem. Soc., 86: 2084-5(May 20, 1964).

Deuterium hydrogen exchange in resorcinols and related compounds was monitored by nmr spectroscopy in D_2O solutions of approximate pH 9. The spectra of phenol, catechol, and hydroquinone in alkaline D_2O did not change during several hours and were the same as their spectra in water. In contrast, the exchange of protons 2, 4, and 6 of resorcinol reached equilibrium in 1 hr at pH ca 8 and in 10 min at pH ca 11. Hydrogens in phloroglucinol also exchanged rapidly. Exchange reactions in other compounds are also discussed. No general direct relation was

found to exist between the effect of substituents on the chemical shift of a particular proton and their effect on the rate of exchange. (P.C.H.)

25454 KINETICS OF PYROLYSIS OF ISOPROPYL IODIDE. Hiroshi Teranishi and Sidney W. Benson (Univ. of Southern California, Los Angeles). J. Chem. Phys., 40: 2946-51(May 15, 1964).

The kinetics of the pyrolysis of isopropyl iodide was investigated in the temperature range 270° ~ 300°C using a spectrophotometric technique for determination of I_2. The reaction was found to proceed through an I atom and radical chain mechanism to yield C_3H_6, C_3H_8, and I_2. The reaction velocity is determined by slow unimolecular decomposition. The rate data give the following equation for k_5: $\log k_5 = 12.96 - 43.5/\theta$ (sec^{-1}), with $\theta = 2.303$ RT in kilocalories per mole. The activation energy E_5 and Arrhenius factor, A_5, show good agreement with the values previously reported by Jones and Ogg. The contribution of a reported autocatalytic reaction to the velocity of pyrolysis is found to be negligibly small or less than 8% of that of the unimolecular decomposition process throughout the temperature range of the present experiment. There is evidence for the beginnings of a falloff in rate constant with pressure at about 30 mm Hg. At 15 mm Hg the falloff does not exceed 25%. Combination of the rate constants for the forward and reverse reactions leads to an equilibrium constant $K_{5,6}$ lower by a factor of about 2 than that determined previously from direct equilibrium studies. It is proposed that the kinetic constant is probably the more reliable. Values of $\Delta S_{5,6}$ and $\Delta H_{5,6}$ computed from the kinetic data are in excellent agreement with independent estimates. (auth)

25455 FLUORESCENCE PROPERTIES OF EUROPIUM DIBENZOYLMETHIDE AND ITS COMPLEXES WITH LEWIS BASES. Robert C. Ohlmann and Robert G. Charles (Westinghouse Research Labs., Pittsburgh). J. Chem. Phys., 40: 3131-3(May 15, 1964).

Decay time and relative fluorescence intensity was studied for EuD_3 and its solid complexes with Lewis bases (electron-donor molecules). (R.E.U.)

25456 A SPECTROPHOTOMETRIC STUDY OF THE NAPHTHAZARIN AND β-HYDRONAPHTHAZARIN CHELATES OF TITANIUM, ZIRCONIUM, HAFNIUM, THORIUM AND NEODYMIUM. R. S. Bottei and D. Quane (Univ. of Notre Dame, Ind.). J. Inorg. Nucl. Chem., 26: 537-47(Apr. 1964).

A spectrophotometric study of the titanium–, zirconium–, hafnium–, and thorium–naphthazarin systems in absolute ethanol using the method of continuous variations, indicates compositions with metal to ligand ratios between 1 : 1 and 1 : 2. Formation constants are calculated for these systems on the assumption that there is an equilibrium between 1 : 1 and 1 : 2 species absorbing at the same wavelength. The formation constants for both the 1 : 1 and 1 : 2 complexes are in the order: Th > Zr > Hf > Ti. A similar study of the same metals with β-hydronaphthazarin shows that titanium, zirconium, and thorium form complexes with the same composition as the naphthazarin complexes, but that hafnium forms only a 1 : 1 complex. The formation constants of the 1 : 1 complexes are in the order: Ti > Th > Zr > Hf; while those of the 1 : 2 complexes are: Th > Ti > Zr. The complexes formed by both ligands with the tripositive rare earth ion, neodymium, are of the same type as the Group IV complexes, and formation constants were calculated. (auth)

25457 CHELATING TENDENCIES OF SOME SUBSTITUTED 2-(PYRIDYL)-1,3-INDANEDIONES WITH BIVALENT-METAL IONS. J. R. Cook and D. F. Martin (Univ. of Illinois, Urbana). J. Inorg. Nucl. Chem., 26: 571-7(Apr. 1964).

The acid dissociation constants of six substituted 2-(pyridyl)- and 2-(quinolyl)-1,3-indanediones and formation constants of three of these with some bivalent-metal ions were determined at 30°C in a 75% (v/v) dioxane-water solution. The influence of steric, solvent, and electronic effects on the values of the formation constants is considered. Evidence is presented that suggests that solvent or electronic effects are responsible for the variations of chelating tendencies. (auth)

25458 THE SYNTHESIS AND INFRA-RED SPECTRUM OF CARBON-DEUTERATED ETHYLENEDIAMINE DIHYDROBROMIDE. R. W. Gaver and R. K. Murmann (Univ. of Missouri, Columbia). J. Inorg. Nucl. Chem., 26: 881-5 (May 1964).

Ethylenediamine-C-$\underline{d}_4$ · 2HBr is produced in 80 to 90% yield by the reaction of anhydrous NH_3 with 1,2-dibromoethane-$\underline{d}_4$ in a sealed tube at 55°C. An estimation of the level of C–H impurity was made from a comparison of the infrared spectra of normal and carbon-deuterated ethylene diamine dihydrobromide and verified by the nuclear magnetic resonance spectra of the free amines. Little or no hydrogen exchange on the carbon atoms occurs during the reaction and subsequent purification. On the basis of simplicity, high yield, relative freedom from side reactions, and lack of isotopic exchange, this method is suggested for the preparation of carbon and hydrogen isotopically substituted ethylenediamine. (auth)

25459 TRITIUM-LABELED COMPOUNDS. XI. MECHANISM FOR THE OXIDATION OF ALDEHYDES AND ALDOSES-1-$\underline{t}$ WITH SODIUM CHLORITE. Horace S. Isbell and Lorna T. Sniegoski. J. Res. Natl. Bur. Std., 68A, 301-(May-June 1964).

Measurements of kinetic isotope-effects (k*/k) for the oxidation of ten aldoses-1-t with sodium chlorite in acid solution gave values ranging from 0.56 to 0.75, with an average of 0.66. The values show that the Cl–H* bond is not ruptured in the rate-determining step. For the reaction, a mechanism is proposed that accounts for this fact and for the dependence of the rate of reaction on the concentration of chlorous acid. The mechanism involves formation of a chlorous acid—aldehyde intermediate; this decomposes, giving the aldonic acid and hypochlorous acid. The latter then reacts with more chlorous acid, affording the chlorine dioxide and hydrogen chloride found experimentally. (auth)

25460 THE PREPARATION OF SODIUM DIMETHYLDITHIOCARBAMATE-^{35}S AND POTASSIUM ETHYLXANTHATE-^{35}S BY ISOTOPE EXCHANGE REACTION. Toshio Sato (Tohoku Univ., Sendai). Nippon Kagaku Zasshi, 85: 215-19(Mar. 1964). (In Japanese)

The isotope exchange reaction in some organic S compounds and its application for the preparation of ^{35}S-labeled compounds were studied. The exchange reaction between $(CH_3)_2NCSSNa$(I) and ^{35}S(II), C_2H_5OCSSK(III) and II, and I and $NaH^{35}S$(IV) were examined by the acid decomposition method instead of by the ordinary precipitation method, and the adequate condition required for completion of the exchange of two S atoms was found in each reaction. The reaction between III and II was completed within half an hour at room temperature, while the reaction between I and II was rather slow and required 3 hr at 60°C for completion. From these reactions I-^{35}S and III-^{35}S were easily isolated with the radiochemical yield of 72 and 80%, respectively. The reaction between I and

IV reached to the exchange equilibrium after 3 hr with heating at 130°C in a sealed tube. From the reaction, I-^{35}S was isolated, with the radiochemical yield of 61%. The reaction was explained in terms of a mechanism involving $H^{35}S^-$ addition to the C-S group in comparison with the reaction between I and $Na_2{}^{35}S$. The resulting I-^{35}S was derived to some related ^{35}S-labeled compounds. (auth)

25461 THE PREPARATION OF SODIUM N-METHYLDITHIOCARBAMATE-^{35}S. Toshiro Sato (Tohoku Univ., Sendai). Nippon Kagaku Zasshi, 85: 220-3(Mar. 1964). (In Japanese)

The following three reactions as the methods for preparing ^{35}S-labeled $CH_3NHCSSNa$(I) were studied; the exchange reaction between I and ^{35}S; the exchange reaction between I and $NaH^{35}S$; and the reaction of CH_3NCS with $NaH^{35}S$. In the first reaction, the exchange of two S atoms was observed at room temperature, was completed after 3 to 5 hr. The second reaction was so slow that it required 3 hr with heating at 100°C for the completion. A discussion on the mechanism of this reaction was made in comparison with the exchange reaction between I and $Na_2{}^{35}S$. The third reaction proceeded smoothly at room temperature, and gave I-^{35}S. By using the described reactions, I-^{35}S could be isolated with the radiochemical yield of 50%, 59%, and 87%, respectively. (auth)

25462 SPECTRA AND QUANTUM STATES OF EUROPIUM β-DIKETONE CHELATES IN POLYMETHYLMETHACRYLATE. Nelson McAvoy, Nicolae Filipescu, Morton R. Kagan, and Francis A. Serafin (Melpar, Inc., Falls Church, Va.). Phys. Chem. Solids, 25: 461-8(May 1964).

An analysis of the absorption spectra of different Eu β-diketone chelates led to a detailed spectroscopic investigation of Eu tris (4,4,4-trifluoro-1,2 thienyl-1,3 butanedione) chelate dissolved in polymethylmethacrylate and other hosts, at different temperatures and concentrations. The mechanism responsible for the line fluorescence is attributed to an intramolecular energy transfer from the triplet states of the organic chelate to the $^5D_0$ and $^5D_1$ resonance energy levels of the central europium ion. The concentration, temperature and host dependent fluorescence spectrum of Eu chelate were investigated and interpreted. The absorption and phosphorescence spectra of the identical gadolinium chelate in different hosts were related to the overall transfer mechanism and the lowest-lying triplet states. The "molecular field splitting" effects are observed at low temperatures for the $^7F_0 \rightarrow {}^5D_2$ transition and interpreted based on structural criteria. The intramolecular energy transfer was tentatively formulated based on the admixture of the biradical triplet state of the chelate with the emitting levels of the europium ion. (auth)

25463 SOLUTION PROPERTIES OF STEREOREGULAR POLYACIDS. John Joseph O'Neill. Thesis, Brooklyn, Polytechnic Inst. of Brooklyn, 1963. 173p.

Recent theoretical studies have indicated that configuration sequence, should through its influence on conformation, be an important factor in determining the solution properties of certain vinyl polyelectrolytes such as polymethacrylic acid (PMA) and polyacrylic acid (PAA). Isotactic and syndiotactic polymethacrylic acids have been prepared and studied by pH titration, enthalpy titration, and interaction with copper(II). The syndiotactic polyacid (85% syndiotactic triads by NMR of the derived polymethyl methacrylate) is similar to ordinary PMA (57% syndiotactic). Isotactic PMA (90% isotactic triads), is insoluble at low degrees of neutralization (α); it is a weaker acid by about 0.4 pK independent of α and level of neutral salt, and binds copper(II) about three times as strongly (equilibrium dialysis). The α dependence of the copper binding ratio indicates that there are two carboxylate ions in the syndiotactic complex, one in the isotactic. Microcalorimetric determination of the heat of neutralization as a function of α shows that tacticity influences acidity primarily through the dissociation enthalpy. The dissociation enthalpy decreases with increasing α, more rapidly in water than in salt solution, the concomitant increase in the free energy of dissociation being due to the rapid decrease in entropy of dissociation. In the presence of copper(II) there are large effects on the heat of reaction with base, corresponding, in general, with the α regions of large pH effect. The reaction of syndiotactic PMA with copper(II) is endothermic to the extent of about 8 kcal per mole of copper. The visible and ultraviolet absorbancies of the copper-PMA complex are quite sensitive to tacticity, especially at high pH where the possibility of a tacticity index is indicated. The experimental results have been interpreted in terms of a helical structure analogous to that of crystalline, stereoregular polymethyl methacrylate; in the syndiotactic helix the carboxyl groups are associated in physically distinct pairs separated by similar pairs of α-methyl groups; in the isotactic chain the carboxyl and methyl groups alternate. Solubility differences are attributed to differences in hydrogen bonding capacities in accord with this conformation. In PAA the degree of steric hindrance is very much smaller than in PMA; however, a comparison of the two systems is hampered by a lack of an unequivocal method for the determination of tacticity of PAA. The titration curves of "atactic" and isotactic polyacrylic acids were only marginally different; there are indications that in this system the "atactic" polyacid is predominantly isotactic. The effect of strong configurational restriction was studied by crosslinking of polyacrylic acid (microsol copolymer with divinylbenzene); this causes a "parallel" shift in the titration curve without change of shape. The variation of tacticity of PMA's prepared from the monomer by γ-ray initiation in water with α indicates that charge favors syndiotactic placement to about the same extent that would be predicted from the effect of tacticity on the free energy of dissociation. From the effect of polymerization temperature on tacticity in the absence of charge, it is estimated that the enthalpy and entropy of activation for isotactic placement are greater than those for syndiotactic placement by 1.2 kcal/mole and 1.5 eu/mole, respectively. An attempt to study the proton NMR spectra of PMA's in D_2O failed for lack of signal strength and resolution under conditions which gave good spectra of structurally similar monomeric acids. The experimental results show that tacticity can have a significant effect on solution properties of polyelectrolytes. (Dissertation Abstr.)

Radiation Chemistry and Radiochemistry

25464 (AE-142) RADIOLYSIS OF AQUEOUS BENZENE SOLUTIONS. Hilbert Christensen (Aktiebolaget Atomenergi, Stockholm). May 1964. 41p.

Aerated and deaerated aqueous solutions of benzene were irradiated with ^{60}Co γ rays. The products of radiolysis in deaerated, unbuffered, or acid solutions were phenol, biphenyl, hydrogen, and in acid solutions also hydrogen peroxide with the following yields: G(phenol) = 0.37 (0.37), G(biphenyl) = 1.3 (1.7), $G(H_2)$ = 0.44 (0.43), and $G(H_2O_2)$ = 0 (0.60); the figures in brackets give the results for acid

solutions. The results are shown to agree with the conclusion that $k(e^-_{aq} + H_2O_2) \gg k(H + H_2O_2)$. Furthermore, the results indicated that a competition takes place between the reactions: $2\ C_6H_6OH \cdot \rightarrow$ dimer $\rightarrow$ biphenyl and $C_6H_7 \cdot + C_6H_6OH \cdot \rightarrow$ dimer $\rightarrow$ biphenyl. The yields in aerated, unbuffered, or acid solutions were: G(phenol) = 2.1 (2.3), G(biphenyl) = 0 (0), and $G(H_2O_2) = 2.2$ (3.1), with the figures in brackets valid for acid solutions. The ratio $k(H + C_6H_6)/k(H + O_2)$ was 1.4×10^{-2}. The results indicated that peroxides, or more probably hydroperoxides, take part in the reactions. After the addition of Fe^{2+} or Fe^{3+} to aerated acid solutions G(phenol) was increased to 6.6 and 3.4 respectively. Oxygen was consumed more rapidly in the presence of Fe^{2+}. The reaction mechanisms are discussed. (auth)

25465 (AERE-R-4581) THE RADIOLYTIC OXIDATION OF METHANE. PART I. THE PRODUCTION OF METHYL HYDROPEROXIDE AND FORMALDEHYDE. J. A. Hearne and R. W. Hummel (United Kingdom Atomic Energy Authority. Research Group. Wantage Research Lab., Wantage, Berks, England). Feb. 1964. 19p.

The yields of methyl hydroperoxide and formaldehyde from the 4-Mev-electron and ^{60}Co-γ radiolyses of a 10% O_2-CH_4 mixture at 25°C, were studied over pressure and dose rate ranges of 1 to 76 cm Hg and 1.82×10^{14} to 9.62×10^{17} ev ml^{-1} min^{-1} normalized to 20°C and 76 cm Hg. $G(CH_3OOH)$ increased from 0.9 to 6.0 with increasing dose rate (at atmospheric pressure) and increased from 1.7 to 6.0 with increasing pressure (at the highest dose rate). $G(CH_2O)$ was about half $G(CH_3OOH)$ and behaved similarly with respect to dose rate and pressure. The results obtained are tentatively explained on the basis of published data for the oxidation of methyl radicals and hydrogen atoms. (auth)

25466 (AERE-R-4587) A REVIEW OF FREE RADICAL ADDITION REACTIONS INITIATED BY HIGH-ENERGY RADIATION. R. A. Johnson (United Kingdom Atomic Energy Authority. Research Group. Wantage Research Lab., Wantage, Berks, England). Apr. 1964. 34p.

The state of knowledge in the field of free radical addition to unsaturated carbon-carbon bonds initiated by high energy radiation is reviewed. Reactions involving polymerization and aromatic double bonds were excluded. The radical addition reaction is discussed in general terms. Specific reactions reported in the literature are described, with the emphasis placed on those reactions initiated by high-energy radiation. (auth)

25467 (AWRE-O-54/57) PERMEABILITY OF SOME SYNTHETIC RUBBERS TO HYDROGEN. F. P. Evans (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Oct. 16, 1957. 11p.

Experimental values for the rates of permeation of hydrogen through vulcaprene, polyamide epoxy, butyl rubber, and polyvinyl alcohol are given. The effects of low concentrations of β radiation on latex, neoprene, and vulcaprene are described and the observations are discussed. (auth)

25468 (BNL-845) THE EFFECT OF REACTOR IRRADIATION UPON HYDROGEN ADSORPTION BY AN ALUMINA CATALYST. D. B. Rosenblatt and G. J. Dienes (Brookhaven National Lab., Upton, N. Y.) Feb. 1964. Contract AT-30-2-GEN-16. 7p.

Hydrogen adsorption experiments were carried out on unirradiated and reactor-irradiated samples of gamma alumina ($\gamma-Al_2O_3$) in an effort to interpret the known enhancement by a radiation of the catalytic activity of this material. The specific surface area of 85 m^2/g was not changed by irradiation, but the shapes of the hydrogen adsorption isotherms were altered. The observed monolayer capacity for hydrogen indicated that hydrogen atoms are adsorbed (at 78°K) in one-to-one correspondence with the oxygen ions in the alumina surface. Nitrogen contamination, which is not removed by outgassing at 300°C, was detected. It is displaced systematically as hydrogen is adsorbed at 78°K. Reactor irradiation appeared to enhance this nitrogen release phenomenon. (auth)

25469 (SRIA-120) RADIATION-INDUCED REACTIONS IN SWOLLEN POLYMERS. Final Report. Zoila Reyes (Stanford Research Inst., Menlo Park, Calif.). Nov. 30, 1963. Contract AT(04-3)-115. 42p.

Studies were carried out on the effects of gamma irradiation on casein and on its radioinduced reactions. Free radicals and dose rate dependence were investigated. Radioinduced grafting of styrene and acrylonitrile was studied by direct irradiation of casein swollen in monomer-solvent mixtures and by post-irradiation swelling of irradiated casein. Molecular weight measurements were made on the grafts. (D.L.C.)

25470 (AEC-tr-6372) ANNUAL REPORT OF THE JAPANESE ASSOCIATION FOR RADIATION RESEARCH ON POLYMERS, VOLUME 3, 1961. Translation of Nippon Hoshasen Kobunshi Kenkyu Kyokai Nempo, 3: 1961. 668p.

Seventy-five articles are included; separate abstracts were prepared for 72. One article on the business report of the Japanese Association for Radiation Research on Polymers was not abstracted in NSA. (P.C.H.)

For abstracts of individual papers see: 25471, 25472, 25473, 25474, 25475, 25476, 25477, 25478, 25479, 25480, 25481, 25482, 25483, 25484, 25485, 25486, 25487, 25488, 25489, 25490, 25491, 25492, 25493, 25494, 25495, 25496, 25497, 25498, 25499, 25500, 25501, 25502, 25503, 25504, 25505, 25506, 25507, 25508, 25509, 25510, 25511, 25512, 25513, 25514, 25515, 25516, 25517, 25518, 25519, 25520, 25521, 25522, 25523, 25524, 25525, 25526, 25527, 25528, 25529, 25530, 25531, 25532, 25533, 25534, 25535, 25536, 25537, 25829, 25830, 26171, 26812, and 26813.

25471 (AEC-tr-6372(p.49-59)) RADIATION-INDUCED THERMOLUMINESCENCE. I. RADIATION-INDUCED THERMOLUMINESCENCE OF POLYETHYLENE. Yota Nakai, Harumi Izura, Koji Matsuda, Saburo Ohara, Kusuo Yamaguchi, and Kiichi Kimura. (Translation)

Radioinduced thermoluminescent glow curves were obtained for polyethylene and were analyzed to provide information to clarify the luminescence mechanism. To study other radiation effects and post-irradiation effects following exposure to ionizing radiation, uv light, infrared light, and sunlight were used. A glow curve for polyethylene shows peaks at −175, −120, and −35°C. The −35°C peak is unstable and varies between −30 to −50°C, depending on factors such as dose and type of polyethylene. Permanent changes were brought about under repeated irradiation. A great decrease in the light flux following exposure to uv, IR, or sunlight was found. The intensity of the glow curves decreased even though the material was kept in the dark after irradiation at −196°C. Temperature, radiation dose, and type of radiation were also found to have effects on the glow curves. (P.C.H.)

25472 (AEC-tr-6372(p.61-74)) RADIATION-INDUCED THERMOLUMINESCENCE. II. RADIATION-INDUCED

THERMOLUMINESCENCE OF BENZENE DERIVATIVES. Yota Nakai, Kusuo Yamaguchi, Saburo Ohara, Harumi Izura, Koji Matsuda, and Kiichi Kimura. (Translation)

Radioinduced thermoluminescence of organic compounds containing the benzene ring as a nucleus, such as benzene, naphthalene, and anthracene, was investigated. Special attention was given to factors that affect the shape and intensity of glow curves. These factors include weight of the sample, thickness, transparency, surface conditions, and crystal state. In the case of anthracene, electric conductivity seems to be related to electrons and positive holes. Whole single crystals of anthracene (platelets) conduct light and the powder does not; however, the two materials have nearly the same amount of light (actually the powder emits more light). This indicates that thermoluminescence is a localized phenomenon resulting from the recombination of an electron and a positive hole. Other results are also discussed. (P.C.H.)

25473 (AEC-tr-6372(p.75-82)) RADIATION-INDUCED THERMOLUMINESCENCE. III. RADIATION-INDUCED THERMOLUMINESCENCE OF TRIOXANE AND DIOXANE. Yota Nakai, Saburo Ohara, Kusuo Yamaguchi, Harumi Izura, Koji Matsuda, and Kiichi Kimura. (Translation)

The radioinduced thermoluminescence of dioxane and trioxane was investigated. Although trioxane and dioxane are very similar in chemical structure, no common peaks were observed in their glow curves. The glow curves of both materials following irradiation at low temperature decayed even though kept at low temperature. Changes in the glow curves with dose or the phenomenon of decay were reminiscent of the behavior of inorganic crystals under the same conditions. This indicates that the behavior of inorganic crystals can be extended to organic crystals to a certain degree. No connection between post-irradiation polymerization and thermoluminescence was indicated. (P.C.H.)

25474 (AEC-tr-6372(p.83-8)) RADIATION-INDUCED GRAFT POLYMERIZATION ON CELLULOSE. NO. 6. EFFECT OF SOLVENTS ON GRAFT REACTIONS ON SEVERAL TYPES OF CELLULOSE. Ichiro Sakurada, Norio Okada, and Nariyuki Hatakeyama. (Translation)

Studies were made on the effects of solvents on the radioinduced graft polymerization of styrene to ordinary viscose rayon, super-strength rayon, polynojiks, and cotton utilizing simultaneous or pre-irradiation. Methanol was found to be effective for all types of cellulose while formamide and dimethyl sulfoxide were fairly effective. Ethanol, n-propanol, acetic acid, and dimethyl formamide were effective to a limited degree. Reactivity according to cellulose types follows the descending order of cotton, polynojiks, ordinary viscose rayon, and super-strength rayon. (P.C.H.)

25475 (AEC-tr-6372(p.89-96)) RADIATION-INDUCED GRAFT POLYMERIZATION ON CELLULOSE. NO. 7. EFFECT OF PRETREATMENT ON RADIATION-INDUCED GRAFT POLYMERIZATION ON CELLULOSE. Ichiro Sakurada, Norio Okada, Fujiko Kimura, and Namiko Minegawa. (Translation)

Four types of cellulose, including cotton and rayon along with cotton cloth, were investigated for their graft reactivity, in which the effects of the degree of refining, pretreatment, and several types of chemical treatment on the graft rate were studied. Viscose rayon readily entered into grafting as long as the material was taken after the desulfurizing stage. The graft rate of raw cotton was greatly increased by presoaking in cold water. Mercerizing cotton brought about only minor changes in the graft rate. The graft reactivity of non-crystalline rayon and cotton made non-crystalline by treatment with acrylonitrile by pre-irradiation was very low. When the same materials were grafted by simultaneous irradiation, reactivity was at least at the level of the original material. It was concluded that pretreatment of fiber is tied in with the capture of activated sites, and the more crystalline the material, the more capacity it has for capture-activated sites, thereby bringing about greater reactivity. (P.C.H.)

25476 (AEC-tr-6372(p.97-102)) RADIATION-INDUCED GRAFT POLYMERIZATION ON CELLULOSE. NO. 8. GRAFT COPOLYMERIZATION OF STYRENE AND ACRYLONITRILE ON VISCOSE RAYON. Ichiro Sakurada, Norio Okada, and Nariyuki Hatakeyama. (Translation)

Copolymerization of styrene and acrylonitrile (AN) on viscose rayon by simultaneous irradiation in vacuum was carried out. The graft rate obtained with a mixed monomer system was greater than with individual monomers, and the maximum rate was observed when the AN concentration in the monomer was 50–75%. Acceleration of the grafting was greatest when the monomer solution had a methanol concentration of 25–75%. Accelerating effects were also seen when dimethyl sulfoxide or acetic acid was used as solvent in place of methanol. (P.C.H.)

25477 (AEC-tr-6372(p.103-8)) RADIATION-INDUCED GRAFT POLYMERIZATION ON CELLULOSE. NO. 9. GRAFT POLYMERIZATION OF BUTADIENE ON CELLULOSE. Ichiro Sakurada, Norio Okada, Fujiko Kimura, and Namiko Minegawa. (Translation)

Radioinduced graft polymerization of butadiene to viscose rayon was attempted, and the properties of the resultant product were tested. The homopolymerization rate of butadiene monomer was only about $1/12$ that of styrene, but it was a relatively simple matter to achieve graft rates of 50% with cellulose by selecting appropriate conditions such as irradiating the swollen material immersed in the monomer. Softness and elasticity of the product were better than the original material, and the heat setting property, adhesion to rubber and dyeability, was improved. (P.C.H.)

25478 (AEC-tr-6372(p.109-15)) RADIATION-INDUCED GRAFT POLYMERIZATION ON CELLULOSE. NO. 10. GRAFT COPOLYMERIZATION OF BUTADIENE–STYRENE ON CELLULOSE. Ichiro Sakurada, Norio Okada, Fujiko Kimura, and Namiko Minegawa. (Translation)

When cellulose fiber (ordinary fiber) was immersed in the three-component butadiene-styrene-methanol system and graft reactions initiated by simultaneous irradiation, it was found that at some favorable monomer composition, graft rates as high as 10,000% could be achieved without loss of the fiber properties. The high graft rate depends on the composition of the monomer mixture. The maximum comes at a butadiene content of 4–14% regardless of the relative amount of methanol. Within the range investigated, the larger the methanol content, the greater the height of the maximum. The high graft rates were not attained by pre-irradiation or the use of catalysts, and the principal product was a graftless popcorn polymer. Consequently, a tie-in between the high graft rate and the formation of popcorn polymer is suspected. (P.C.H.)

25479 (AEC-tr-6372(p.117-23)) RADIATION-INDUCED GRAFT POLYMERIZATION ON CELLULOSE. NO. 11. GRAFT COPOLYMERIZATION OF BUTADIENE–ACRYLONITRILE ON CELLULOSE. Ichiro Sakurada, Norio Okada, and Namiko Minegawa. (Translation)

Graft copolymerizations were carried out by immersing cellulose fiber (ordinary staple fiber) in a three-component butadiene-acrylonitrile-methanol system and gamma irradiating. When roughly 1:1 mixtures of the two monomers were mixed, graft rates exceeding 10,000% were attained under the same conditions, at which the graft rates of the individual monomers were 72.5% for butadiene and 16.1% for acrylonitrile. (P.C.H.)

25480 (AEC-tr-6372(p.125-7)) RADIATION-INDUCED GRAFT POLYMERIZATION ON CELLULOSE. NO. 12. ON MONOMER REACTIVITY DURING GRAFT COPOLYMERIZATION. Ichiro Sakurada, Norio Okada, and Nariyuki Hatakeyama. (Translation)

The product composition of graft copolymerization of a two-component monomer system to cellulose was investigated to determine whether there was a difference in behavior between simple copolymerization and graft copolymerization. Tests were made initially with the products of simultaneous irradiation of butadiene-acrylonitrile and styrene-acrylonitrile. More grafted acrylonitrile than ungrafted polymer was seen. (P.C.H.)

25481 (AEC-tr-6372(p.129-34)) RADIATION-INDUCED GRAFT POLYMERIZATION ON CELLULOSE. NO. 13. GRAFT COPOLYMERIZATION OF BUTADIENE–STYRENE OR BUTADIENE–ACRYLONITRILE ON SEVERAL TYPES OF CELLULOSE. Ichiro Sakurada, Norio Okada, and Namiko Minegawa. (Translation)

Investigations were made on the graft copolymerizations of butadiene–styrene and butadiene–acrylonitrile monomers on four types of cellulose; ordinary viscose fiber, super type viscose fiber, polynojics fiber, and Egyptian cotton. Graft rates of more than 10,000% were obtained under the proper conditions between butadiene–styrene and ordinary and super viscose. These rates could not be obtained with the more crystalline polynojics and cotton, thereby indicating that the fine structure of cellulose plays an important part in the reaction. Higher graft rates were generally attainable with the butadiene–acrylonitrile monomer system, but reactivity of the different cellulose types was about the same as with the butadiene–styrene system. The graft rate increased in proportion to the non-crystallinity of the cellulose once a certain graft rate had been reached. (P.C.H.)

25482 (AEC-tr-6372(p.135-40)) RADIATION-INDUCED GRAFT POLYMERIZATION ON POLYVINYL ALCOHOL. NO. 15. GRAFT POLYMERIZATION AND GRAFT COPOLYMERIZATION OF BUTADIENE ON POLYVINYL ALCOHOL FIBER. Ichiro Sakurada, Norio Okada, and Takeo Takabayashi. (Translation)

Simultaneous gamma irradiation of butadiene and PVA at 1×10^5 r showed that a graft rate of about 50% was attained. The graft reactions of butadiene–styrene or butadiene–acrylonitrile with PVA show unusually high graft rates (several thousand percent) at optimum mix ratios similar to the cellulose case. However, when PVA fiber was heat treated at over 130°C, it was difficult to get graft rates exceeding 10% with butadiene–acrylonitrile despite adjustment of the relative monomer concentrations. (P.C.H.)

25483 (AEC-tr-6372(p.141-3)) RADIATION-INDUCED GRAFT POLYMERIZATION ON POLYVINYL ALCOHOL. NO. 16. GRAPHIC X-RAY ANALYSIS OF THE EFFECT OF HEAT TREATMENT OF GRAFT POLYMERIZATION. Ichiro Sakurada, Norio Okada, and Yasu Asano. (Translation)

The effects of heat treatment on wide- and narrow-angle scattering of x rays from radiation graft-polymerized PVA were investigated. Styrene was used as the monomer. The heat treated material showed a R_3 interference peak of PVA at $2\Theta = 19°$. On heat treating the peak was sharpened and two peaks not seen prior to heat treatment appeared. One was the R_1 at $2\Theta = 10°$ and the other was R_4 at 22°. As the graft rate increased, the PVA content decreased. (P.C.H.)

25484 (AEC-tr-6372(p.145-57)) RADIATION-INDUCED GRAFT POLYMERIZATION OF CONJUGATED DIENE MONOMER ON POLYETHYLENE. Ichiro Sakurada, Norio Okada, and Takeo Takabayashi. (Translation)

Homopolymerizations of butadiene, isoprene, and chloroprene were carried out, and it was found that the polymerization rate was greater when the monomer was diluted twice over with methanol than with pure monomer. The polymerization rate of chloroprene was greater than that of styrene, but rates for butadiene and isoprene were much smaller than that of styrene. The graft reactions of the diene monomers to polyethylene fiber under simultaneous irradiation proceeded smoothly in every case. Here again, diluting the monomer with methanol resulted in greater grafting rates. When a graft copolymerization with the two component butadiene–styrene system was attempted, the graft rate dropped rapidly with an increasing butadiene content. With the butadiene–acrylonitrile system, a very pronounced maximum was observed near the region where the butadiene content was about 25%. A relatively small maximum was observed at high chloroprene content in the chloroprene–styrene system. Products of graft reactions obtained within the range covered were, for the greater part, soluble in the solvent. It is believed that cross-linking reactions have been fairly limited. (P.C.H.)

25485 (AEC-tr-6372(p.159-61)) RADIATION-INDUCED HOMOGENEOUS GRAFT POLYMERIZATION ON POLYVINYL ALCOHOL. Ichiro Sakurada, Norio Okada, and Hitoshi Abe. (Translation)

The mechanism of radioinduced homogeneous graft polymerization of acrylamide on PVA was investigated. Conditions for graft reactions and composition of the graft products are tabulated. The results show that a substantial yield of the graft product was obtained in every case. (P.C.H.)

25486 (AEC-tr-6372(p.163-73)) BETA-INDUCED POLYMERIZATION OF STYRENE. Ichiro Sakurada and Norio Okada. (Translation)

Studies on the polymerization of styrene showed that the polymerization velocity is proportional to $I^{1/2}$ up to a dose of 10^7 rad/min. On the other hand, the molecular weight remained at about 20,000 even at high dose rates. The departure of the molecular weight from the $I^{1/2}$ relation is thought to be due to the difficulty in gathering the low molecular weight fraction and is not believed to be a fundamental flaw. The addition of diphenylpicrylhydrazyl greatly reduced the reaction. The results indicate that polymerization takes place mostly by a radical mechanism even up to dose rates as high as 10^7 rad/min. (P.C.H.)

25487 (AEC-tr-6372(p.175-84)) EFFECT OF BORIC ACID DURING HEATING OR IRRADIATION OF POLYVINYL ALCOHOL. Ichiro Sakurada, Norio Okada, and Akiko Tanaka. (Translation)

PVA film with boric acid additions was heat treated for 100 hours at 140°C. The results showed very little coloring, and growth of $-C=O$, $-C=C-$ type absorption was not detectable by ir analysis. PVA film, however, showed the growth of $-C=O$, $-C=C-$ absorptions and increasing

absorption of the crystal band. There seems to be little connection between this effect and the concentrations of the solutions used to make the PVA film and washed film. While results are not very clear cut regarding irradiating at room temperature and heating-irradiating compared with heat treating alone, the effect of the addition of boric acid was clearly seen. (P.C.H.)

25488 (AEC-tr-6372(p.185-92)) BETA-INDUCED CROSSLINKING OF POLYVINYL ALCOHOL. Ichiro Sakurada, Norio Okada, and Hitoshi Abe. (Translation)

PVA fiber and film swollen in water were irradiated in air at room temperature with a beta beam. The gel fraction was determined, from which crosslinking effects were followed. With a given material, the fiber with the higher water content seemed to favor crosslinking. This was found not to be due to a greater crosslinking rate but to a decreased disintegration rate. Fiber given small doses improved in its strength, elongation, or Young ratio, but these properties deteriorated as the dose was increased. Elasticity seemed to increase at some favorable dose, but changes over the entire dose range were slight. (P.C.H.)

25489 (AEC-tr-6372(p.193-5)) BETA IRRADIATION OF ACETYLATED POLYVINYL ALCOHOL. Ichiro Sakurada, Norio Okada, and Hitoshi Abe. (Translation)

Acetylated PVA was exposed to beta irradiation in doses up to 100 Mrad in air at room temperature. Mechanical properties were measured. Strength was found to decrease in every instance, but the decrease was the least for pure PVA with mere heat treatment, and the greatest with formate. The largest decrease with formate extended up to a dose of 10 Mrad following which the decrease was not very pronounced. The decrease in strength of the chloro acetoacetal compound was small. The decrease in elongation was generally small. Elongation of dry nonyl compound showed a slight tendency towards increased reduction at the highest doses. There was little effect on the Young ratio of the dry material. Pure PVA and formate fiber showed clear cut increases. The Young ratio of wet formate was smaller at the extremes of the dose range. (P.C.H.)

25490 (AEC-tr-6372(p.197-205)) REACTIONS OF IRRADIATED POLYMER WITH CHLORINE OR SULFUR DIOXIDE. Ichiro Sakurada, Norio Okada, and Tetsunari Shiota. (Translation)

Propene, ethylene, styrene, and vinyl alcohol polymers and nylon tetrone were pre-irradiated in air, immersed in carbon tetrachloride containing chlorine, and allowed to chlorinate at near room temperature. Pre-irradiation made polypropylene very reactive, and polystyrene was slightly less active. Very little radiation effect was seen with polyethylene. Reactions between polypropylene pre-irradiated in air with SO_2, $SOCl_2$, or SO_2Cl_2 in CCl_4 were attempted at 30°C, but no radiation effects were observed. Pre-irradiation greatly promoted the reaction of a $SO_2 + Cl_2$ mixture in CCl_4, and weight increases up to 85% were obtained. The Cl and S contents of the products showed wide variation with the composition of the reacting mixture. The graft reaction between pre-irradiated polypropylene and styrene-polysulfone was found to proceed very smoothly. The composition of the grafted branches was nearly always a ratio of 2:1 styrene to SO_2. (P.C.H.)

25491 (AEC-tr-6372(p.207-12)) RADIATION-INDUCED POLYMERIZATION OF VINYLENE TYPE MONOMERS. Seizo Okamura, Koichiro Hayashi, Hakuo Hamada, and Yoko Nakamura. (Translation)

The effects of molecular structures, particularly isomers, on the radioinduced polymerization of vinylene type monomers were investigated. The behavior of cis and trans vinylene type monomers was compared, and the kinetics of radioinduced polymerization of diethyl fumarate was studied. G values for the polymer from the trans monomers diethyl fumarate (FE) and dimethyl fumarate were 300 to 400, and the products were molecules of considerable size. In contrast, the polymer formation from cis monomers like dimethyl fumarate, 3,6-endomethylene Δ^4 tetrahydrophytol acid anhydride, 2,5-endomethylene Δ^3 1,2,5,6-tetrahydrobenzoate, and maleic anhydride had G values of about 10, and the product molecules were small. FE polymerized fairly readily giving yields up to 60–70%. The activation energy is 6.8 kcal/mole. It is speculated that the reason for the low reactivity of vinylene monomers may be due to mutual annihilation of the effects of two exchangeable groups with C=C. (P.C.H.)

25492 (AEC-tr-6372(p.213-22)) RADIATION-INDUCED POLYMERIZATION OF FORMALDEHYDE. NO. 3. COPOLYMERIZATION REACTIONS. Seizo Okamura, Koichiro Hayashi, and Nishi Yamaoka. (Translation)

Studies were made on the radioinduced polymerization of formaldehyde with methyl styrene, p-methoxy styrene, methyl methacrylate, and acrylonitrile and the kinetic aspects of the reactions. The results showed that α-methyl styrene reacts slightly while p-methoxy styrene hardly ever co-polymerizes. X-ray diffraction patterns and solubility of the various polymer products were nearly identical with the formaldehyde homopolymer. Results with methyl methacrylate and acrylonitrile were similar. (P.C.H.)

25493 (AEC-tr-6372(p.223-35)) RADIATION-INDUCED POLYMERIZATION OF KETENE TYPES. NO. 1. RADIATION-INDUCED POLYMERIZATION OF KETENE. Seizo Okamura, Koichiro Hayashi, and Kikuo Fujiwara. (Translation)

The radioinduced polymerization of ketene was found to give rise to polyesters from liquid phase reactions and polyesters with 50% or more poly ketones from solid state reactions. The products are crystalline but have low degrees of polymerization. (P.C.H.)

25494 (AEC-tr-6372(p.237-46)) RADIATION-INDUCED POLYMERIZATION OF KETENE TYPES. NO. 2. RADIATION-INDUCED POLYMERIZATION OF DIMETHYL KETENE. Seizo Okamura, Koichiro Hayashi, and Kikuo Fujiwara. (Translation)

Block polymerization of dimethyl ketene and copolymerizations with carbonyl compounds are described. The reactivity of the substances and the properties of the products are discussed. The product of radiation induced polymerization of dimethyl ketene has a polyacetal structure, and no differences between the products of liquid and solid phase reactions were found. The cause for the difference between this reaction and that of ketene is not clear, although steric hindrance by methyl groups is suspected. The reaction mechanism is thought to be anionic from the results of structure and liquid phase reaction studies. Polyacetal type copolymers are readily formed with aldehyde types, but ketone types did not form polyacetals. (P.C.H.)

25495 (AEC-tr-6372(p.247-59)) SOLID-STATE POLYMERIZATION OF N-CARBOXY ACID ANHYDRIDES. Seizo Okamura, Koichiro Hayashi, and Tadao Natori. (Translation)

N-carboxy anhydrides (NCA) of glutamic acid and α-alanine were irradiated in the solid state, but no acceleration to polymerization by the irradiations was ob-

served. NCA glutamate polymerizes on heating. Several observations pertinent to the solid state polymerizing mechanism and the behavior of various optical isomers are reported. (P.C.H.)

25496 (AEC-tr-6372(p.261-72)) RADIATION-INDUCED POLYMERIZATION OF PHOSPHONITRILE CHLORIDE. Seizo Okamura, Koichiro Hayashi, and Hakuo Hamada. (Translation)

The radioinduced polymerization of phosphonitrile chloride was investigated. Measurements were made on the relation between the rate of polymerization and dose rate as well as temperature. The rate and yield between polymerizations of the trimers and tetramers were also compared. Solution phase polymerization in several solvents was also studied, and the reaction rate was found to be vastly accelerated in the liquid phase. Similar studies were also made with derivatives of PNC, including phenol, p-cresol, aniline, and amine derivatives. Thermal polymerization of the derivatives gave plastics with a high degree of polymerization. When polymerizations were attempted in air at 50°C, even a dose of 10^8 rad beta brought about no visible changes in the phenol, p-cresol, and amine derivatives. The radioinduced polymers of PNC were all low molecular weight products with few rubbery characteristics. Spectra of the polymers are discussed. (P.C.H.)

25497 (AEC-tr-6372(p.273-86)) RADIATION-INDUCED POLYMERIZATION OF OXETANE DERIVATIVES. Seizo Okamura, Koichiro Hayashi, and Haruhiko Watanabe. (Translation)

Nineteen oxetane derivatives and three β-propiolactone derivatives were synthesized and their behavior on exposure to radiation was studied. The results showed that the solid state polymerizing behavior is dictated by the monomer crystal structure, which depends upon the size, symmetry, and polarity of the replaceable group. The fact that oxetane derivatives polymerize only in the solid state under irradiation indicates that oxetane derivatives polymerize only by ion catalysis, and the initiating ions created by irradiation are more stable in the solid than the liquid state. It also indicates that polymerization takes place by an energy transfer mechanism and the transfer is more readily accomplished in the solid state. (P.C.H.)

25498 (AEC-tr-6372(p.287-90)) RADIATION-INDUCED THERMOLUMINESCENCE OF β-PROPIOLACTONE AND POST POLYMERIZATION. Seizo Okamura, Koichiro Hayashi, Kiyohiko Mori, and Yota Nakai. (Translation)

Radioinduced thermoluminescence and post polymerization of β-propiolactone were investigated with the aim of clarifying the relation between the two processes as well as the ion mechanism associated with polymerization. The results showed that of six thermoluminescent glow peaks, one behaved quite similar to post-polymerization behavior with respect to the dose rate or the irradiation temperature. It was concluded that an activation point (ionic) associated with this peak was responsible for initiating the post polymerization. On the other hand, ESR spectral studies made at the same time indicated that radical behavior also has to be taken into account. (P.C.H.)

25499 (AEC-tr-6372(p.291-7)) UV-INDUCED SOLID-STATE POLYMERIZATION OF β-PROPIOLACTONE. Seizo Okamura, Koichiro Hayashi, and Masahiro Sakamoto. (Translation)

Ultraviolet radiation was used to bring about radioinduced solid state polymerization of the β-propiolactone polymer. Since radiation was reflected off the surface and did not penetrate the crystals, polymerization took place only on the surface and the yield was small. However, it was clearly apparent that uv-induced polymerization took place. The saturation yield was attained in about an hour, and no further increase in yield was seen. It is believed that similar to the ionizing radiation case, decomposition products from uv irradiation inhibit the polymerization. The effects of light intensity, temperature, and crystallinity are discussed. (P.C.H.)

25500 (AEC-tr-6372(p.299-310)) POST IRRADIATION POLYMERIZATION OF TRIOXANE. Seizo Okamura, Koichiro Hayashi, and Hiroshi Ochi. (Translation)

The kinetics of post-polymerization of trioxane were investigated and attempts are made to explain the creation of activated sites for polymerization. Saturation yields obtained in the post-polymerization of trioxane are shown to be proportional to the pre-irradiation dose. It is assumed that formation of activated sites is proportional to the pre-irradiation dose and the monomer concentration but is not related at all to the dose rate. Since it is a solid-state reaction, the rate of growth is proportional to the monomer concentration. The reaction is greatly influenced by the presence of oxygen, the apparent activation energy is over 40 kcal/mole, and the minimum temperature at which polymerization begins is about 40°C. The production of peroxides in the post-polymerization is discussed. (P.C.H.)

25501 (AEC-tr-6372(p.311-21)) CRYSTAL STRUCTURE OF RADIATION-INDUCED POLYMERS FROM RING CLEAVAGE. Seizo Okamura, Koichiro Hayashi, and Masanobu Nishii. (Translation)

X-ray diffraction studies were used to investigate crystal structure of polymers radioinduced in trioxane, β-propiolactone, diketene, and 3,3-bis-chloromethylcycloxabutane. A characteristic yield saturation was observed with both β-propiolactone and diketene and the polymerization rate did not exceed 15%. As a result, the product polymer may be biaxially oriented within the monomer, but it loses this regularity when the bulk of the monomer is removed and resembles fiber bundles. The same type of behavior was also seen with trioxane, in which the single crystal type properties of the polymer were lost when the bulk of the monomer was removed with polymerizations not exceeding a 20% yield. This may be the reason that single crystal behavior or biaxial orientation is not seen outside of the trioxane polymer. (P.C.H.)

25502 (AEC-tr-6372(p.323-30)) ON EPITAXY ASSOCIATED WITH RADIATION-INDUCED SOLID STATE POLYMERIZATION. Seizo Okamura, Koichiro Hayashi, and Masanobu Nishii. (Translation)

Studies were made on epitaxy reactions in the radioinduced polymerization of acetaldehyde, propionaldehyde, trioxane, hexamethylcyclotrissiloxane, diketene, β-propiolactone, and oxetanes in the solid state. Epitactic polymerization is involved in the formation of a six-sided polymer with twin crystal formation in a fixed direction, which may be due to steric properties associated with the monomer. (P.C.H.)

25503 (AEC-tr-6372(p.331-47)) ON THE RATE OF RADIATION-INDUCED POLYMERIZATIONS BY RING CLEAVAGE. Seizo Okamura, Koichiro Hayashi, Waso Kamada, and Masanobu Nishii. (Translation)

Studies were made on the reaction velocity from the standpoints of distribution of molecules within the crystal and activity of the molecules in the radioinduced poly-

merization of β-propiolactone, trioxane, oxetanes, silicone polymers, styrene, benzaldehyde, and vinyl toluene. Limiting conditions for the formation of intermolecular orbitals and the decrease in activation energy (AE) are described and are used to explain the lowering of AE at low temperature solid state conditions in an approximate manner. A large AE for the soft crystal state just below the melting point indicates that reactions take place by molecular collisions as a consequence of molecular distribution and interactions. Therefore, most of the important solid state polymerizations by ring cleavage, in the temperature range in which these reactions are possible, are determined by molecular distribution and interactions. From results of ir, NMR, and differential thermal analysis, along with polymerization rate measurements, it was concluded that conditions conducive to polymerization are for the molecules to be aligned in suitable directions and to possess reasonable activities. (P.C.H.)

25504 (AEC-tr-6372(p.349-61)) RADIATION-INDUCED CHLORINATION REACTIONS OF POLYVINYL CHLORIDE. Seizo Okamura, Koichiro Hayashi, and Tadao Natori. (Translation)

Studies on the radioinduced chlorination of polyvinyl chloride showed that the reaction takes place by chain reactions at the methylene groups, and 1,2-dichloroethylene type polymer is formed. The terminating reaction is bimolecular. The yield per unit dose decreases with increasing dose. The role of the swelling agent is to facilitate diffusion of chlorine into the polymer. At the same time, 1,1-dichloroethylene type polymer formation is suppressed by radicals formed in the swelling agent. Chlorination of the polymer is desirable because the original properties of the powdery polymer are not lost. The softening point and solubility of the chlorinated product are better than that of the original polymer, while no sacrifice is made in mechanical strength. (P.C.H.)

25505 (AEC-tr-6372(p.363-9)) GRAFT POLYMERIZATION FOLLOWING PRE-IRRADIATION IN AIR BY A $B^{10}(n,\alpha)Li^7$ REACTION. NO. 2. POLYPROPYLENE FILM. Kozo Hirota, Masao Umezawa, and Junichi Takezaki. (Translation)

The radioinduced graft polymerization of polypropene to acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene was investigated and the effects of alpha pre-irradiation, grafting temperature, time, and storage on graft rate reactions and free radical decay were studied. The effects of adding alcohol or organic acid to the reaction system were also investigated. Temperature was found to have a great effect on graft polymerizations. However, there was no special alpha particle effect on the graft reaction with 2-methyl-5-vinyl pyridine. Both types of reactions increased with increasing temperature. The addition of alcohol (butanol, ethanol, and methanol) also did not increase the graft rate. On the contrary, the graft rate was decreased due to a dilution effect. (P.C.H.)

25506 (AEC-tr-6372(p.371-7)) GRAFT POLYMERIZATION FOLLOWING PRE-IRRADIATION IN AIR BY A $B^{10}(n,\alpha)Li^7$ REACTION. NO. 3. POLYPROPYLENE FIBER. Kozo Hirota, Masao Umezawa, and Junichi Takezaki. (Translation)

The effects of alpha pre-irradiation on the radioinduced graft polymerization of polypropylene on acrylonitrile, styrene, and 2-methyl-5-vinyl pyridine were investigated. Fibers of 100 denier (3.3 denier single strand) were used. The effects of alpha radiation were found to increase with a longer graft time. The main reason for this is the large polymer surface per unit weight, which makes alpha radiation more effective. Another reason is that irradiation was made while it was contained in a solution, as contrasted to the film case. Alpha irradiated samples also had an increased graft rate with the addition of ethanol and benzoic acid. (P.C.H.)

25507 (AEC-tr-6372(p.379-85)) RADIATION-INDUCED POLYMERIZATION OF VINYL ACETATE IN THE PRESENCE OF IODINE. Kozo Hirota and Akira Shingyonai. (Translation)

The radioinduced polymerization of vinyl acetate in the presence of iodine was investigated. It was found that the rate of polymer formation increases with irradiation. This shows that it may be possible to say that ions formed by irradiation accelerate polymerization. The amount of polymer formed increased almost linearly with the amount of iodine added. The structure of the polymer was studied by ir spectrometry. When spectra of the brown-black polymer and polyvinyl acetate were compared, the overall absorption patterns were nearly identical. (P.C.H.)

25508 (AEC-tr-6372(p.387-95)) RADIATION-INDUCED POLYMERIZATION OF ETHYLENE IN PRESENCE OF TITANIUM TETRACHLORIDE. Kozo Hirota and Masao Yamamoto. (Translation)

The radioinduced polymerization of ethylene in the presence of titanium chloride gave rise to polyethylene with a molecular weight of about 30,000, while irradiation of ethylene alone gave no polymer. Titanium tetrachloride is reduced by gamma irradiation to initiate polymerization. The product polymer was found not to have any outstanding properties. (P.C.H.)

25509 (AEC-tr-6372(p.397-404)) RADIATION-INDUCED REACTION BETWEEN ACETALDEHYDE AND ETHYLENE. Kozo Hirota, Shinji Iizuka, and Motoyoshi Hatada. (Translation)

The radioinduced reaction between acetaldehyde and ethylene was investigated. When the reaction was pressurized up to 50 kg/cm^2 at room temperature, $G(-C_2H_4)$ went up to 4000 and there was a more pronounced effect to the 1:2 product yield of methyl n-butyl ketene than to the 1:1 product yield of methyl ethyl ketone. Increasing the temperature favored the reaction up to a pressure of 10 kg/cm^2, while higher pressures showed an opposite effect. (P.C.H.)

25510 (AEC-tr-6372(p.405-12)) RADIATION-INDUCED TELOMERIZATION OF CYCLOHEXENE AND ACETALDEHYDE. Kozo Hirota, Junichi Takezaki, and Motoyoshi Hatada. (Translation)

Yields in the radioinduced telomerization of acetaldehyde with cyclohexene and n-hexene-1 were studied. Cyclohexamethyl ketone was formed in the acetaldehyde-cyclohexene system and methyl n-hexyl ketone and methyl isohexyl ketone in the n-hexene-1-acetaldehyde system. The maximum G value was obtained at an olefin content of about 10% in both systems. Dose rate, temperature, and benzene additive effects are discussed. (P.C.H.)

25511 (AEC-tr-6372(p.413-19)) SYNTHESIS OF TERTIARY AMYL ALCOHOL USING A VAN DE GRAAFF BETA BEAM. Kozo Hirota and Motoyoshi Hatada. (Translation)

The synthesis of tertiary amyl alcohol by irradiation of an ethylene-isopropanol mixture using a Van de Graaff beta beam is described. Values from the beta beam were far below those from gamma irradiation previously used. This is explained in terms of the $-1/2$ power dependence on dose rate for the former. (P.C.H.)

25512 (AEC-tr-6372(p.421-30)) TEMPERATURE CHANGES TO THE ESR SPECTRA OF IRRADIATED POLYETHYLENE. Isamu Nitta, Shunichi Onishi, and Shunichi Sugimoto. (Translation)

Irradiation of polyethylene gives rise to three types of radicals. The radicals show an ESR sextet (30 gauss separation), doublet septet (18 gauss separation), and a singlet. Temperature changes to the septet were observed and results were analyzed by means of a restricted vibration model. It was concluded that spectral changes due to temperature result from changes to the β proton coupling constants. The -196 and -180°C spectra are very nearly the same, indicating that there is little change in spectra as the temperature goes below -180°C. (P.C.H.)

25513 (AEC-tr-6372(p.431-5)) ESR OF IRRADIATED POLYISOBUTYLENE. Isamu Nitta and Shunichi Onishi. (Translation)

Radicals produced in polyisobutylene (PIB) by low temperature irradiation were identified by ESR, and changes in the line widths associated with radical activities with increasing temperature were investigated. The results were compared with results from former studies on irradiated PIB as well as molecular activities by NMR, and a radioinduced reaction mechanism for PIB is theorized. It was found that irradiation of PIB gives rise to the $-C(CH_3)_2-CH-C(CH_3)_2-$ radical with $G_R = 3$. As the temperature is raised to about -130°C, molecular chain activity and the C_3 dislocation take place, and the radicals begin to react and disappear. (P.C.H.)

25514 (AEC-tr-6372(p.437-43)) EFFECT OF RADIATION ON POLYOXYMETHYLENE. Isamu Nitta, Shunichi Onishi, and Yoshiharu Nakajima. (Translation)

Polyoxymethylene was irradiated at a low temperature (-195°C) and studies were made on the effects brought about by irradiation, which became evident as the temperature was raised to try to elucidate the decomposition mechanism. The free radicals produced by low-temperature irradiation and their activities were followed by electron spin resonance activities measurements. Qualitative as well as quantitative measurements were also made of the gases evolved. It was found that free radicals began to decay at about -160°C and decay monotonously from then on. The volume of gas evolved was dependent upon the irradiation temperature. The principal constituents of the expelled gas were CO_2 and CH_4; small amounts of H_2 and CO were also released. It was concluded that the gas produced by radiolytic decomposition is a product of secondary reactions of free radicals, and chain type molecular splitting reactions can be envisioned. (P.C.H.)

25515 (AEC-tr-6372(p.445-53)) EFFECT OF RADIATION ON POLYETHYLENE GLYCOL. Isamu Nitta, Shunichi Onishi, and Yoshiharu Nakajima. (Translation)

Radiation effects on spectra as well as gas evolution with rising temperature of polyethylene glycol were studied. The details of free radical decay were observed along with the reactivity of the radicals themselves. It was found that irradiation of PEG brought about a breaking of the main chain similar to polyoxymethylene. The radicals, however, recombined with rising temperature, an effect different from polyoxymethylene. (P.C.H.)

25516 (AEC-tr-6372(p.455-8)) DIFFERENCES IN RADIATION BEHAVIOR OF POLYOXYMETHYLENE AND POLYETHYLENE GLYCOL. Isamu Nitta, Shunichi Onishi, and Yoshiharu Nakajima. (Translation)

ESR spectral methods were used to investigate the physical properties exhibited by radicals formed by chain breaking of polyoxymethylene and polyethylene glycol. The same angular dependence of ESR spectra was found with trioxane and the POM crystal obtained from single crystal trioxane. The anisotropy is thought to be a function of the G-value. (P.C.H.)

25517 (AEC-tr-6372(p.459-64)) ESR OF IRRADIATED ACRYLAMIDE. Isamu Nitta, Shunichi Onishi, and Tadayoshi Tanei. (Translation)

Radical structure, radical distribution within the crystal, and radical reactions with increasing temperature were studied in irradiated solid acrylamide by ESR spectrometry. Spectral anisotropy was seen in spectra taken at -196°C. This effect was very pronounced about the b axis (ac plane) and the a′ axis (bc plane) but was not pronounced about the C axis (a′b plane). The $CH_3-CH-CONH_2$ radical explains most of the observed effects. It is believed that temperature effects may indicate that as the temperature rises from -196°C, the $CH_3-CH-CONH_2$ radical gradually changes to a growth type radical, and the latter becomes more populous than the former at -94°C. The growth radical is the only one left at -30°C. (P.C.H.)

25518 (AEC-tr-6372(p.465-71)) ESR OF THE ACRYLIC ACID RADICAL. Isamu Nitta, Shunichi Onishi, and Yuji Shioji. (Translation)

Radical anisotropy in irradiated acrylic acid was studied with respect to a magnetic field. The radical produced in acrylic acid irradiated at -196°C was identified as the $CH_3-\dot{C}H-COOH$, which resulted from addition of one H to a vinyl group. The radical is magnetically anisotropic. The three β-H's of the methyl group already in rotation at -196°C give rise to the quartet, while the single α-H gives rise to the ESR doublet. The principal values of the α-H hyperfine coupling constant tensor and the principal axis are 8.5 gauss in the $C-H_\alpha$ direction, 31.8 gauss along the C—C—C chain direction, and 24.2 gauss normal to the C—C—C plane. The β-H hyperfine coupling constant varies with the angle between the rotational axis ($C_\alpha-C_\beta$ direction) of the methyl group and the external magnetic field. This amounts to an averaging of the three $C-H_\beta$ vectors. The position of the C—C—C framework within the crystal is unchanged by radiation. (P.C.H.)

25519 (AEC-tr-6372(p.473-80)) RADIATION-INDUCED POLYMERIZATION OF ACRYLIC ACID. Isamu Nitta, Shunichi Onishi, and Yuji Shioji. (Translation)

ESR studies were made on the radioinduced polymerization of acrylic acid. Acrylic acid ($CH_2=CH-COOH$) adds one H to the double bond upon exposure to radiation to give the ($CH_3-\dot{C}H-COOH$) radical, which is very stable at -196°C. The G (radical) at -196°C is 1.2. This is a polymerization initiating radical and begins polymerization as the temperature is raised. Radical concentration begins to drop off at about -100°C, and at the same time the ESR spectra change to a broad triplet while the reaction initiating radical changes to a chain propagating radical. At these low temperatures the reaction rate is very slow, and practical polymer yields are obtained from about -25°C and up. Pre-treatment at -78°C for 30 minutes of material pre-irradiated at -196°C gave results that negate the possibility of an ion reaction. The lack of an effect of the pre-treatment on the reaction velocity, stopping (restraint) of the polymerization reaction by oxygen, and the linearity of the log $(1/(1-Y))$ versus log t plot all are indicative of a radical mechanism that involves a bimolecular termination step. (P.C.H.)

25520 (AEC-tr-6372(p.481-90)) ESR OF IRRADIATED BENZENE AND BENZENE DERIVATIVES. Isamu Nitta, Shunichi Onishi, and Tadayoshi Tanei. (Translation)

Benzene was irradiated at −196°C, and the primary radical was studied in detail with ESR spectra along with the primary process of the radioinduced reaction. ESR studies of irradiated benzene derivatives were repeated to gain more insight to the reaction. Monosubstituted benzene derivatives such as toluene, phenyl cyclohexane, chlorobenzene, benzoic acid, and polystyrene as well as disubstituted derivatives such as o-, m-, and p-xylene form radicals on irradiation with ESR spectra. The spectra are triplets very similar to those of benzene. The results indicate that radicals from the derivatives result from the addition of an H to the benzene nucleus. The individual spectra are discussed. (P.C.H.)

25521 (AEC-tr-6372(p.491-2)) ESR OF IRRADIATED ACETONE. Isamu Nitta and Shunichi Onishi. (Translation)

ESR spectral studies were made on color changes in acetone when irradiated at −196°C. If the material is exposed to sunlight for one hour at the same temperature, the color is completely bleached or at best is very light. The unbleached spectra show an unsymmetric singlet near the center. The singlet gradually disappears by fading and is not seen when the color is gone. Only a triplet remains. The triplet (21 gauss separation) is thought to be due to the CH_2CCCH_3 radical. The shape of the triplet shows little change with rising temperature and no sharpening due to motion is seen. (P.C.H.)

25522 (AEC-tr-6372(p.493-4)) ESR OF IRRADIATED CYCLOPENTADIENE. Isamu Nitta and Shunichi Onishi. (Translation)

Cyclopentadiene was beta irradiated at −196°C and the ESR spectra were measured to study the radicals formed. The material became orange-yellow after irradiation. A narrowing of the spectra is observed in the central portions with rising temperature and six sharp peaks appear near the center (6 gauss separation) at −108°C. The narrowing begins at about −165°C. Lowering the temperature restores the original shape. The spectrum is thought to be a composite of two radicals. (P.C.H.)

25523 (AEC-tr-6372(p.495-8)) ESR OF IRRADIATED CYCLOHEXENE. Isamu Nitta, Shunichi Onishi, and Yoshiharu Nakajima. (Translation)

Cyclohexene was irradiated at −196°C and studies were made on the radicals formed, the resulting color, the behavior of the radicals to uv radiation, and the behavior of the radicals as the temperature was raised. The material turned yellow upon irradiation and then turned brown upon exposure to visible light. However, there was little change to the ESR spectra. A very pronounced narrowing effect was seen upon heating. It was concluded that uv irradiation causes some changes to radical activity. (P.C.H.)

25524 (AEC-tr-6372(p.499-501)) ESR OF IRRADIATED N-HEXADECYNE-1. Isamu Nitta, Shunichi Onishi, and Yoshiharu Nakajima. (Translation)

n-Hexadecyne-1 was irradiated, and ESR measurements were used to follow changes in color, radical formation, effects of uv radiation following ionizing radiation, and radical behavior with rising temperature. Upon exposures to visible light the color faded but no change in ESR spectra was seen. A sample that was irradiated for comparative purposes turned a light brown. When the material was irradiated with uv following beta bombardment, the spectra gradually changed. There was little change in radical density at this stage. The spectra following uv irradiation seemed to show an apparent sharpening of lines, but the cause is undetermined. (P.C.H.)

25525 (AEC-tr-6372(p.503-10)) SUMMARY RESEARCH REPORT OF THE TOKYO LABORATORY. Kenichi Shinohara. (Translation)

Research carried out during 1961 including studies on radiation sources, electron spin resonance of irradiated polymers, radioinduced polymerizations, and radiation chemistry of low molecular weight compounds is described. (P.C.H.)

25526 (AEC-tr-6372(p.521-32)) THE 500-CURIE COBALT-60 FACILITY OF THE TOKYO LABORATORY. Kenichi Shinohara and Tomomichi Shigematsu. (Translation)

Design of a ^{60}Co irradiation facility is given. The large size of the irradiation chamber makes possible experiments with large space requirements. Furthermore, there are four 2.5-cm ports for electrical cables and eight 0.3-cm ports for fluid passage (also can be used for high-pressure work). Dose rate measurements were made based on the source being 500°C. After making appropriate corrections for capsule and protector absorption, the results came close to Fricke values. (P.C.H.)

25527 (AEC-tr-6372(p.533-8)) BETA-INDUCED CROSSLINKING REACTIONS OF POLYESTER RESIN. Kenichi Shinohara and Tomomichi Shigematsu. (Translation)

Radioinduced crosslinking experiments were made on a polyester resin formed by a condensation reaction between 0.5 mole maleic acid as the unsaturated acid component, 0.5 mole of anhydrous phytic acid as the saturated acid component, and 1.05 mole of propylene glycol. The results indicate that the hardening reaction of polyester resin takes place by radical mechanism. Some degree of induction period is inevitable. It was found that the hardening of the resin can be accomplished in a very short time, and the proper choice of dose rate will prevent too low a degree of hardening. (P.C.H.)

25528 (AEC-tr-6372(p.539-46)) RADIATION-INDUCED CROSSLINKING OF EPOXY RESINS. (NO. 2). Kenichi Shinohara and Tomomichi Shigematsu. (Translation)

The effects of irradiation on hardening of epoxy resin with di- and triethylamines, pyridine, and piperidine were investigated. The combined use of irradiation with heat was found to be much more effective than if a polyamine were used. When a small amount of water was present, the reaction velocity was greatly accelerated. Addition of DPPH had no effect, while water had a great effect on the rate of the reaction, indicating that it proceeds by an ion type mechanism. The thermal reaction was also attributed to an ion reaction, and it was suggested that the ion type reaction would be accelerated by irradiation. This was deduced from the lack of difference in activation energies between irradiated and non-irradiated cases. (P.C.H.)

25529 (AEC-tr-6372(p.547-54)) CRYSTAL STATE AND ESR OF POLYETHYLENE. NO. 1. SPECTRAL CONSIDERATIONS. Naoyuki Tamura and Kenichi Shinohara. (Translation)

The crystal state of polyethylene was studied by following the form and intensity of ESR spectra following irradiation at 77°K. Intensity was independent of crystal state, but changes in form were found. Assuming this effect to be due to localized distribution of radicals in the neighborhood of the molecular chains, the relation between spectral form

and crystal state was investigated. The results showed that when the molecular chain was encased as a planar zig-zag configuration of good crystallinity, the spectra were very sharp, while the spectra were diffuse when this condition was not met. The overall spectra were found to be dependent upon contributions from the various crystal states. Spin-spin interaction was not substantiated. (P.C.H.)

25530 (AEC-tr-6372(p.555-62)) DOUBLET QUINTET ESR SPECTRA OF IRRADIATED POLYTETRAFLUOROETHYLENE (NO. 2). Naoyuki Tamura and Kenichi Shinohara. (Translation)

Irradiation of polytetrafluoroethylene (PTFE) gives rise to the $-CF_2-\dot{C}F-CF_2-$ radical whose ESR spectra is a doublet quintet. Existence of vibrational activity below the room temperature rotational transition temperature was confirmed by NMR measurements. The calculated amplitude of molecular vibration is reasonable from the stereochemical viewpoint but seems to be on the high side. This may be due to direct application of the simple relation of the $B\cos^2\theta$ angular dependence to the F of PTFE. Explanation of temperature changes to the quintet separation by the molecular vibration model is discussed and seems reasonable. Therefore, it is thought that the complex temperature effects on the doublet quintet of PTFE can be partially explained by the mechanism of line width changes with the molecular chain rotation. (P.C.H.)

25531 (AEC-tr-6372(p.563-74)) RADIATION-ACTIVATED RADICALS IN POLYVINYL FLUORIDE AND POLYVINYLDINE FLUORIDE. Naoyuki Tamura and Kenichi Shinohara. (Translation)

Radicals produced in polyvinyl fluoride (PVF) and polyvinyldine fluoride (PVdF), which are considered to have properties intermediate to polyethylene (PE) and polytetrafluoroethylene (PTFE), were studied by ESR spectroscopy. Results showed that both materials give rise to three radical species. The H and F coupling constants from PE and PTFE were utilized to identify the respective spectral components. The two main radical species of PVF and PVdF disappear at temperatures below room temperature. It was not possible to formulate theoretical treatment connecting the radical decay with molecular activity due to the lack of necessary physical measurements. It is believed that localized molecular activities play a large role. (P.C.H.)

25532 (AEC-tr-6372(p.577-86)) ON CAPTURE DOMAINS FOR STABLE RADICALS FROM POLYETHYLENE. Hisatsugu Kashiwabara and Kenichi Shinohara. (Translation)

Radiation effects on polyethylene were studied by ESR spectroscopy, and the behavior of long lived radicals and their capture domains were correlated with crystallographic data. Previous results show that the line widths of polyethylene are fairly broad and the spectra are somewhat diffuse, so that a line by line measurement is rather difficult. As a result it is difficult to make measurements that will clearly relate the interdependence in time of ESR spectral changes with dynamic dispersion. (P.C.H.)

25533 (AEC-tr-6372(p.587-92)) ESR SPECTRA AND PHYSICAL STATE OF ALKYL-TYPE RADICALS FROM POLYETHYLENE. Hisatsugu Kashiwabara and Kenichi Shinohara. (Translation)

Alkyl type radicals radioinduced in polyethylene were studied by ESR spectroscopy. The spectra show three inflection points, which indicate that the radicals are captured at different regions and recombine or decay according to the activities of this capture domain. The points where the decay rates change very rapidly correspond to the transition temperatures. The first point comes at about the secondary transition temperature and the latter at the gamma transition temperature. These events indicate that there is a relation between molecular chain activities associated with dispersion and recombination of the radicals captured by the molecular chains. (P.C.H.)

25534 (AEC-tr-6372(p.593-602)) SIMULTANEOUS IRRADIATION-GRAFT POLYMERIZATION OF STYRENE OF RAYON. Ayao Amamiya and Seiji Ogawa. (Translation)

Conditions were established for the most rapid reactions in the radioinduced graft polymerization of styrene on rayon using the simplest systems. The yield was found to be about 85%, which is not considered unreasonable. The induction period was greatly reduced above 40°C, and at the same time, higher dose rates became more effective. The time required to attain 50% grafting was 2 hr at 4×10^4 r/hr at 50°C. The time can be reduced by point to higher dose rates; however, the time cannot be reduced to less than 30 min. A lower temperature is desirable from the standpoint of the properties of the products. In terms of the heat treatment temperature, this is about 40°C. (P.C.H.)

25535 (AEC-tr-6372(p.603-12)) RADIATION-INDUCED COPOLYMERIZATION OF VINYL-TYPE COMPOUNDS. Hiroshi Sobue, Yoneho Tabata, and Yoshio Hashizume. (Translation)

Studies were made on the radioinduced polymerization of acrylonitrile (AN)-Styrene (St) and AN-methyl methacrylate (MMA). Copolymerization curves were determined in the temperature range from room temperature to −78°C to investigate the effect of temperature on the reaction mechanism. At the same time, the relation between reaction velocity and dose rate, the reaction temperature, as well as the composition of the product, were determined. The products obtained in both systems were soluble in acetone and insoluble in carbon tetrachloride. Infrared spectra showed that the products were similar to those of a mixture of both homopolymers in the AN-St system, but the AN-MMA system showed distinct spectra quite different from those of the homopolymers, indicating the presence of copolymer. The activation energies calculated were 6.90 kcal/mole for the AN-St system and 4.62 kcal/mole for the AN-MMA system. The copolymerization velocity of the AN-St system increased with increasing acrylonitrile concentration. The room temperature velocity of the AN-MMA system decreased with increasing acrylonitrile concentration, but the reverse situation existed at −78°C. (P.C.H.)

25536 (AEC-tr-6372(p.613-16)) GAMMA-INDUCED LIQUID-PHASE POLYMERIZATION OF ACRYLAMIDE. Shoji Shida, Zenichiro Kuri, and Ryugen Yoshimura. (Translation)

Results of studies on the radioinduced polymerization of acrylamide in the liquid phase are reported. The dose rate usually was 2.5×10^4 r/hr, and the irradiating temperature ranged between −78 and 20°C. In the range covered, the yield increased linearly and a G value of 10^6 was about the highest seen. The apparent activation energy was calculated as 1.3 kcal/mole. The reaction was inhibited by radical inhibitors such as oxygen or DPPH. From the results, it was concluded that the reaction in a methanol system takes place by a radical mechanism. (P.C.H.)

25537 (AEC-tr-6372(p.617-25)) RADIATION-INDUCED POLYMERIZATION IN LIQUID SULFUR DIOXIDE. Shoji

Shida, Zenichiro Kuri, and Ryugen Yoshimura. (Translation)

The radioinduced polymerization of vinyl acetate in liquid SO_2 was investigated. Irradiation was with a $10^4 - 10^6$ r/hr ^{60}Co gamma dose from a 1000°C source, while the irradiating temperature was adjusted at the dry ice, liquid nitrogen, and isopentane, n-pentane melting point temperature. The upper temperature limit for the formation of an SO_2 complex was generally low and usually near −20°C. The apparent activation energy was about 3.4 kcal/mole, lower than the radical polymerization value. Infrared spectra showed $-SO_2-$ and $-C-S-C-$ absorptions. Double bond absorption was not in evidence. It was concluded that the reaction takes place by a radical mechanism. (P.C.H.)

25538 FREE-RADICAL YIELDS IN n-ALCOHOLS RESULTING FROM GAMMA IRRADIATION. Imre Zwiebel and Randolph H. Bretton (Yale Univ., New Haven). A.I.Ch.E. (Am. Inst. Chem. Engrs.) J., 10: 339-44(May 1964).

The initial free-radical yields, resulting from gamma irradiation, were measured in five normal alcohols (butanol, ethanol, methanol, pentanol, and 1-propanol). The scavenger technique was employed, using diphenylpicrylhydrazyl (DPPH) as the scavenger. It was found that thorough degassing and drying of the samples was necessary to obtain meaningful results. The radical yields were reported as G-values, and these are in good agreement with results reported in the literature obtained through more complicated methods of determination. No effect of temperature was noted on the yields between −80 and 40°C. As expected, the effect of radiation intensity on the radical formation was linear. A kinetic model is proposed for the scavenger system. (auth)

25539 ELECTRON SPIN RESONANCE INVESTIGATION OF l-CYSTEINE AND l-CYSTINE. Takuo Asia and Yoshihiko Shono. Ann. Rept. Radiation Center Osaka Prefect., 4: 128-9(1963).

Radiation effects on the ESR of l-cysteine and l-cystine, especially the quantitative change with irradiation dose, were investigated. For l-cysteine the influence of dose rate was examined in two different dose rates, 2×10^6 r in 2 and 17 hr. No significant difference was found. The variation of average values indicates the recombination of free radicals produced irradiation in both compounds. The recombination rate in l-cystine was larger than that in l-cysteine. (P.C.H.)

25540 SOME TRENDS IN RADIATION CHEMISTRY. Judith M. Nosworthy (Guy's Hospital, London) and A. J. Swallow. At. Energy Rev., 2: No. 1, 35-63(Mar. 1964).

A review is presented on developments in radiation chemistry up to January 1963. Emphasis is on some of the problems in radiation chemistry and on how they have been are being, or could be solved. The formation of radiolysis products is explained in terms of the interactions and reactions of the various transients, including the free radicals. 166 references are included. (P.C.H.)

25541 STUDY OF THE EFFECT OF THE γ-RADIATION OF COBALT-60 ON THE STRONGLY ALKALINE ANION-EXCHANGE RESINS AV-17 AND AM. M. D. Kalinina, N. I. Nikolaev, M. V. Gur'ev, and N. N. Tunitskiĭ. At. Energ. (USSR), 16: 245-9(Mar. 1964). (In Russian)

The radiation stability of the various resins used in ion-exchange purification methods was less well investigated than other properties of these resins; most of the previous work was carried out with the dry material. Therefore, the behavior of the polymers AV-17 containing 6 and 16% divinyl benzene (designated as AV-17Kh6 and AV-17Kh16, respectively) was examined on exposure in water to a 21,000 g equiv. of Ra ^{60}Co source with a dose rate of 500 rad/sec. It was found that after exposure to a total dose of 4.7×10^8 rad, the weight of the resin decreased in average by 23% while the exchange capacities of AV-17Kh16, AV-17Kh6 and AM were reduced by 73.83 and 94%, and their specific volumes by 35, 45 and 43%, respectively. Irradiation of AV-17Kh6 by a dose of 1.9×10^8 rad resulted in the decrease of its exchange capacity by 56% and of its specific volume by 27%. It was concluded that this resin should not be used at doses exceeding 1×10^8 rad. There were indications that the main alkaline product of the radiolysis, dissolved in water, was HN_3 in the case of AV-17Kh6, and trimethylamine and NH_3 in the case of AV-17Kh16. The latter was found to be more radiation resistant. The exchange capacity was determined by passing 0.1N HCl and 0.01N $CaCl_2$ solutions through the resin-filled columns. (TTT)

25542 FORMATION OF CYSTEAMINE FROM CYSTAMINE INDUCED BY X-RAYS IN PRESENCE OF THIOL REAGENTS. P. Misti-Dorello, M. Boccacci, and M. Quintiliani (Istituto di Sanita, Rome). Atompraxis, 10: 163-4 (Apr. 1964).

The formation of cysteamine from ^{35}S labeled cystamine irradiated with x rays in the presence of N-ethylmaleimide or iodoacetic acid was studied. In this way, it is possible to block the new-formed cysteamine, avoiding its reoxidation to cystamine. A radiochemical yield of about 5 g can be demonstrated under these conditions. The yield is, up to a certain limit, linearly related to x-rays dose and it reaches its maximum value in the absence of oxygen. (auth)

25543 IRRADIATION CAPSULES FOR THE REACTOR IRRADIATION OF ORGANIC LIQUIDS AT ELEVATED TEMPERATURES. E. Proksch and H. Bildstein (Reaktorzentrum, Seibersdorf, Austria). Atompraxis, 10: 171-3 (Apr. 1964). (In German)

The construction of simple irradiation capsules is described and operating experiences with the capsules are reported. The temperatures achieved till now in the core of a swimming-pool reactor operating at 1 to 2 Mw range between 150 and 350°C. They can be kept constant within a few degrees centigrade. (auth)

25544 ENERGY TRANSFER IN THE RADIOLYSIS OF SOLID SYSTEMS. I. RADIOLYSIS OF THE CYCLOHEXANE— BENZENE SYSTEM UNDER THE INFLUENCE OF ^{60}Co γ-RADIATION. J. Kroh and S. Karolczak (Technical Univ., Lodz, Poland). Bull. Acad. Polon. Sci., Ser. Sci., Chim., 12: 157-62(1964).

An investigation was made on the protective effect of benzene in solid phase at low temperatures, in the gamma radiolysis of cyclohexane. In the range of doses applied (1.2×10^{21} to 1.5×10^{22} ev per l), the volume of the H evolved was proportional to the energy absorbed by the system. The $G(H_2)$ values obtained were 4.90 at −196°C and 4.95 at −70°C. The results indicate that, for small concentrations of benzene, scavenging of the radicals and/or the transfer of energy occurs during radiolysis, similarly as in the liquid phase. (P.C.H.)

25545 ENERGY TRANSFER IN THE RADIOLYSIS OF SOLID SYSTEMS. II. RADIOLYSIS OF THE ETHANOL— BENZENE SYSTEM UNDER THE INFLUENCE OF ^{60}Co γ-RADIATION. J. Kroh and J. Mayer (Technical Univ., Lodz, Poland). Bull. Acad. Polon. Sci., Ser. Sci., Chim., 12: 163-7(1964).

The system benzene−ethanol was irradiated in the

solid phase at −196°C under the influence of ^{60}Co γ radiation. The amount of methane produced in the radiolysis of the solutions examined was proportional to the dose of radiation absorbed in the system. For pure deaerated ethanol, $G(CH_4)$ was 0.45 at 20°C and 0.16 at −196°C. For the same two temperatures the $G(CH_4)$ value decreased as the benzene concentration in the mixture was increased. The inhibitory action of benzene in the radiolysis of ethanol can be explained by energy transfer from the excited molecules of ethanol to benzene, or by the scavenging of the radicals by the molecules of benzene. (P.C.H.)

25546 POLYMERIZATION OF ACROLEIN INITIATED BY GAMMA-RAYS. Yoshio Toi, Toshikatsu Fujii, and Yoshikazu Hachihama (Osaka Univ.). Bull. Chem. Soc. Japan, 37: 307-10(Mar. 1964).

The bulk polymerization of acrolein initiated by gamma rays at various temperatures was studied. Most of the polymers obtained at −20 and 10°C were insoluble in organic solvents. On the other hand, most of the polymers obtained at −78°C were soluble in pyridine, dimethylformamide, and dimethylsulfoxide at room temperature. The aldehyde content of the soluble polymer was 75 ~ 85% of the theoretical amount, and its intrinsic viscosity is 0.32 ~ 1.20. The influence of the polymerization temperature on the solubility of the polymer in organic solvents is discussed, as is the polymerization mechanism. (auth)

25547 THE FORMATION OF SULFUR COMPOUNDS IN THE RADIOLYSIS OF A TOLUENE SOLUTION OF SULFUR. Wataru Ando (Radiation Center of Osaka Prefecture, Sakai, Osaka), Ken'ichi Sugimoto, and Shigeru Oae. Bull. Chem. Soc. Japan, 37: 353-7(Mar. 1964).

The radiolysis of a toluene solution of S was investigated. The formations of benzyl mercaptan, hydrogen, and hydrogen sulfide were observed, and their amounts determined under various considerations. The amounts of mercaptan formed increase linearly with the concentration of S, and the reactions seem to proceed through the initial decomposition of toluene to form the benzyl radical, which then opens the S_8 ring molecule to form the mercaptan. The G-value of H formation is considerably larger than that of hydrogen sulfide. Similar studies were made of the systems of toluene−cyclohexane−S and of toluene−carbon disulfide−S in order to clarify the nature of the radiolysis of toluene and S. (auth)

25548 DECOMPOSITION AND ENERGY TRANSFER IN THE RADIOLYSIS OF SULFUR COMPOUNDS IN TOULENE. Wataru Ando (Radiation Center of Osaka Prefecture, Sakai, Osaka), Ken'ichi Sugimoto, and Shigeru Oae. Bull. Chem. Soc. Japan, 37: 357-60(Mar. 1964).

The decomposition yields of organosulfur compounds in toluene were studied using DPPH as a radical scavenger. The effect of the concentration of S compound is quite marked, and the irradiation energy absorbed in the solution of toluene seemed to be transferred to the S compound. The largest energy transfer from toluene was observed in the decomposition of benzyl mercaptan, while the disulfide was found to absorb the energy from the excited toluene less than half as effectively as does the mercaptan. As compared to the mercaptan or the disulfide, benzyl sulfide is far less effective in energy absorption. (auth)

25549 THE RADIATION-INDUCED REACTION OF BENZYL MERCAPTAN AND p-TOLYL MERCAPTAN IN VARIOUS ORGANIC SOLVENTS. Wataru Ando (Radiation Center of Osaka Prefecture, Sakai, Osaka), Ken'ichi Sugimoto, and Shigeru Oae. Bull. Chem. Soc. Japan, 37: 360-5(Mar. 1964).

The decomposition of benzyl mercaptan and p-tolyl mercaptan in various organic solvents was studied. It was found that a radiosensitive solvent such as hexane is readily attacked by the benzyl mercapto radical. When the resulting mercapto radicals are stabilized substantially by resonance, solvent radicals from the radiolysis of solvents will abstract hydrogen from the mercaptan. The G-values of mercaptan decomposition in such solvents as hexane, cyclohexane, acetone, methanol, and dioxane are relatively higher than those in carbon disulfide, benzene, toluene, and nitrobenzene. The reaction presumably proceeds through the energy transfer process from solvent to mercaptan. When an aromatic π-electron system is present in any solvent, the radiation energy absorbed will be dissipated quite readily through electronic excitation to lower-energy levels of the solvent molecule. (auth)

25550 THE RADIATION-INDUCED ADDITION OF HYDROGEN SULFIDE TO PROPYLENE. Ken'ichi Sugimoto (Radiation Center of Osaka Prefecture, Sakai, Osaka), Wataru Ando, and Shigeru Oae. Bull. Chem. Soc. Japan, 37: 365-8(Mar. 1964).

The radioinduced free radical addition of hydrogen sulfide to propylene to give n-propylmercaptan and di-n-propyl sulfide was studied. The direction of the addition to propylene is consistent with that of the radical addition to such olefins previously studied, suggesting that the SH is both the adding and chain-carrying species. The addition of the thiol to propylene was found to undergo a free radical chain reaction, readily yielding di-n-propyl sulfide in the succeeding step. (auth)

25551 THE RADIOLYSIS OF SQUALANE ($C_{30}H_{62}$) FROM −196°C TO 350°C. Kiyoshi Furukawa, Shigeyoshi Arai, Hideo Yamazaki, and Shoji Shida (Tokyo Inst. of Tech.). Bull. Chem. Soc. Japan, 37: 424-5(Mar. 1964).

The effects of temperature on the gamma radiolysis of squalane at −196 to 350°C were studied. The G-values of hydrogen production were nearly constant at 3.8 from −196 to 100°C, but they increased to 7.0 at 350°C. For the other products, such as methane, propane, propene, isobutane, isopentane, hexene, hexane, and octane, increases in G-values in the region from 150 to 300°C were larger than those at lower temperatures. It was concluded that prior to the rupture of C−H bonds, the energy absorbed in a molecule is transferred to the end parts of the molecule and makes their reactivity large enough to separate the hydrogen atoms from the original molecule. (P.C.H.)

25552 RADIOLYSIS OF PROPYLAMINE. A. J. Lorquet. Bull. Soc. Roy. Sci. Liege, 32: 845-53(1963). (In French)

The products of gamma radiolysis and photolysis of propylamine were investigated. Mechanisms are proposed for the formation of the main products of radiolysis. The most important radiolysis mechanism seems to be that which occurs in photolysis. The main mechanism of degradation in the mass spectrometer also occurs in the radiolysis, but is rather inconsequential. (D.C.W.)

25553 THE ELECTROCHEMICAL BEHAVIOR OF RADIOACTIVE IRON AND STEEL SAMPLES. V. I. Spitzin, S. A. Balesin, and K. N. Janduschkin (Inst. for Physics and Chemistry, Moscow). Chem. Tech. (Leipzig), 16: 164-8 (Mar. 1964). (In German)

The electrode potentials of radioactive samples of Armco iron and steel-2 with specific activities of 0.5 and 5.5 m C/g were measured in distilled water and in sodium acid. It was established that the original potential values of the radioactive samples in comparison with the potential values

of nonactive samples are shifted from 100 to 200 mv in the negative direction. The stationary potential value was chiefly dependent on the specific activity. In its increase a tendency for shifting of the stationary potential value in a positive direction was observed. By plotting of the polarization curve it was established that the internal beta and gamma radiation of the sample intensifies the kinetics of the anodic and cathodic processes, and increasing the specific activity of the sample facilitated above all the cathodic process. (tr-auth)

25554 FLUORESCENCE SPECTRUM OF URANYL ION IN NEUTRON-IRRADIATED CAESIUM URANYL NITRATE. R. K. Asundi and R. M. Dixit (Atomic Energy Establishment, Trombay, India). Current Sci. (India), 33: 38-9(Jan. 20, 1964).

The fluorescence spectrum of a sample of $CsUO_2(NO_3)_3$ showed the presence in it already (before irradiation) of a set of weak bands designated previously as sharp bands in addition to its usual characteristic strong bands. On irradiation for periods ranging from 3 to 6 hr, the characteristic bands almost disappeared whereas the sharp bands persisted with much increased intensity. An analysis of the well-developed bands was done and a comparison of the vibrational frequencies among themselves and with those of the mono-alkali salt indicated a close parallelism to similar comparison of the known frequencies in the mono- and di-rubidium uranyl nitrates. Irradiation of cesium uranyl nitrate by a non-reactor source of fast neutrons of energy ~14 Mev, also produced the effects described. However, irradiation by gamma rays or slight irradiation by accelerated electrons (~4 Mev) did not bring about the changes in the fluorescence spectrum of UO_2^{2+} reported. (P.C.H.)

25555 DETERMINATION OF THE NUMBER OF SEPARATED ION PAIRS PRODUCED IN THE IRRADIATION OF A LIQUID. A. O. Allen and Andries Hummel (Brookhaven National Lab., Upton, N. Y.). Discussions Faraday Soc., No. 36, 95-101(1963). (BNL-7096)

The degree of ionization of irradiated hexane in the absence of an applied field was studied by determination of the electrical conductivity in extremely low fields at known radiation intensities and determination of the ionic mobilities. The number of separated ion pairs formed by 1.5-Mev x rays was 0.09 per 100 ev absorbed by the hexane, with a probable uncertainty of 50%. This low value indicated that practically all subexcitation electrons are captured by their parent positive ions before they can escape into the bulk of the liquid. (auth)

25556 CHEMICAL EFFECTS OF THERMAL NEUTRON IRRADIATION OF SOLID ACETYLHYDRAZIDE. Bianca Aliprandi, Rita Pizzella, and Elvira Possagno (CNR, Rome). Gazz. Chim. Ital., 93: 1259-67(Oct. 1963). (In Italian)

The distribution of ^{14}C in chemical products of the nuclear reaction $N(n,p)^{14}C$ in solid acetylhydrazide was determined; irradiation was carried out on 2-g samples in sealed quartz ampoules using an integrated flux of $3 \times 10^{18} \pm 30\%$ n/cm^2. Estimations were carried out gas chromatographically, using suitable derivatives of products where advisable. The following products were determined to contain these percentages of total activity (mean of 3 determinations): methane, 3.0%; CO, HCN, CO_2, C_2H_6, C_2H_4, C_2H_2, C_3H_8, i-C_4H_{10}, n-C_4H_{10}, C_5H_6, each less than 0.3%; total gases, 4.0%. CH_3OH, C_2H_5OH, i-C_3H_7OH, n-C_3H_7OH, i-C_4H_9OH, n-C_4H_9OH, each less than 0.1%. HCHO, 3.6%; CH_3COCH_3, 0.8%; CH_3CHO, C_2H_5CHO, i-C_3H_7CHO, n-C_3H_7CHO, each less than 0.1%, HCOOH, 1.8%; CH_3COOH, 5.8%; C_2H_5COOH, 2.4%; $CH_2(COOH)_2$, 0.3%; $(CH_2COOH)_2$, 0.5%; C_2H_3COOH, i-C_3H_7COOH, n-C_3H_7COOH, each less than 0.1%. CH_3NH_2, 0.1%; $C_2H_5NH_2$, 0.2%; i-$C_3H_7NH_2$, 0.3%; n-$C_3H_7NH_2$, 0.2%; $(CH_3)_2NH$, $(CH_3)_3N$, each less than 0.1%. Total for the identified products was 20.3%. Residue from distillation of acetylhydrazide was 62.5%, the structure of which may be a polymer resulting from simultaneous n and γ irradiation, or alternately the activity is distributed among a great number of products each of which contains only a small amount of activity. These results are compared with earlier studies of neutron irradiation of acetamide. (BBB)

25557 IONIC PARAMAGNETIC SPECIES ASSOCIATED WITH γ-IRRADIATED AMYL DISULFIDE. Frank K. Truby (Sandia Lab., Albuquerque, N. Mex.). J. Chem. Phys., 40: 2768-73(May 15, 1964).

ESR and optical bleaching studies of n-amyl disulfide, γ-irradiated at 77°K in the amorphous state indicate the presence of ionic paramagnetic species in the irradiated material involving unpaired spins localized mainly at the sulfur. A comparison of ESR derivative peak positions from such samples with those arising from an apparent negative ion species produced from amyl disulfide in a tetrahydrofuran matrix indicates that this species may be common to both types of samples. This finding is supported by the fact that the threshold energy for the destruction of the ionic centers by optical bleaching is the same for both types of samples, being 2.1 ± 0.2 ev. If the ESR spectrum of the negative-ion species is subtracted from the initial ionic species spectrum of amorphous amyl disulfide an ESR line shape is obtained which is postulated to result from a positive-ion species. The principal g values obtained for this species are 2.003 ± 0.001, 2.035 ± 0.001, and approximately 2.018. Calculated g values based on a model in which the electron hole is localized on a nonbonding 3p sulfur orbital are in qualitative agreement with the observed g values. The negative-ion species appearing to be common to both types of samples exhibits an axially symmetric g tensor ($g_{||} = 2.003 \pm 0.001$, $g_{\perp} = 2.022 \pm 0.001$). This g tensor symmetry is obtained theoretically using a model in which the unpaired spin is in 3dσ bonding orbitals associated with both sulfurs. (auth)

25558 LUMINESCENCE OF EUROPIUM HEXAFLUOROACETYLACETONATE. F. Halverson, J. S. Brinen, and J. R. Leto (American Cyanamid Co., Stamford, Conn.). J. Chem. Phys., 40: 2790-2(May 15, 1964).

The luminescence spectrum of europium tris-hexafluoroacetylacetonate in various solutions is presented. While the presence of moisture has a marked effect on the spectral appearance of luminescence near 6100 Å, it does not appear to influence the long-lived phosphorescence near 4500 Å. The presence of this blue phosphorescence poses some questions regarding the rates of various energy-transfer processes. (auth)

25559 ORGANIC LIQUID SCINTILLATORS. VI. SUBSTITUTED DISTYRYLBENZENES: SCINTILLATION PROPERTIES AND SPECTRA OF ABSORPTION AND FLUORESCENCE. Adam Heller (Israel Atomic Energy Commission, Rehovoth). J. Chem. Phys., 40: 2839-51 (May 15, 1964).

The preparation, spectra of absorption and fluorescence, and the scintillation properties of 28 derivatives of trans, trans-p-distyrylbenzene are described. Most of the soluble derivatives are efficient primary scintillators in alkylbenzene solutions and are highly efficient secondary scintillators in alkylbenzene solution of p-terphenyl. Solutions with efficiencies exceeding those of the best-reported liquid scintillation systems are described. (auth)

25560 REACTIONS OF PHOTOCHEMICALLY PRODUCED HOT HYDROGEN ATOMS. I. PHOTOLYSIS OF HI AT 1849 Å. Richard M. Martin and John E. Willard (Univ. of Wisconsin, Madison). J. Chem. Phys., 40: 2999-3007 (May 15, 1964). (TID-20229)

Spectroscopic evidence as to the primary processes caused by absorption of 1849-Å radiation by HI is evaluated and clarified as a basis for consideration of chemical reactions of the 3.6 and 2.6-ev H atoms which may be formed at this wavelength. The energetics of possible hot H reactions with HI which might raise ϕ_{H_2} above the value of unity observed at 2537 Å are evaluated. Experimental results are presented on the photolysis of HI by 1849-Å radiation at −78° and 25°C, showing that little or no enhancement of the yield by such hot processes occurs. Quantum yields of HI decomposition at 1849 Å of 0.5 or greater are found in HI−I_2 systems where 90% of the radiation is absorbed by I_2, indicating a high probability of photosensitized decomposition of HI by excited I_2 molecules or of absorption of I_2 fluorescence radiation by HI, or both. (auth)

25561 REACTIONS OF PHOTOCHEMICALLY PRODUCED HOT HYDROGEN ATOMS. II. REACTION AND MODERATION PROBABILITIES FOR 3-ev H ATOMS IN D_2, CD_4, AND C_2D_6 AND FOR 3-ev D ATOMS IN H_2, CH_4, AND C_2H_6. Richard M. Martin and John E. Willard (Univ. of Wisconsin, Madison). J. Chem. Phys., 40: 3007-14 (May 15, 1964). (TID-20247)

Three-electron-volt H atoms produced in D_2, CD_4, or C_2D_6 by the photolysis of HBr may produce HD by hot-atom reaction with the deuterated species, or H_2 by hot reaction with HBr, or may be thermalized by moderating collisions and scavenged by thermal reaction with HBr. Plots of the product ratios, H_2/HD, vs the reactant ratios, HBr/RD, give straight lines. The values of the intercepts are equal to the ratio of the atoms moderated to those which undergo hot reaction with RD in pure RD. From the slopes and intercepts it is possible, with plausible assumptions, to deduce approximate values for the average probability of reaction per collision in the hot range and for the average fractional energy loss per moderating collision with the hydrocarbon. The latter value when compared with the calculated loss for elastic collisions gives an indication of the inelasticity of the collisions in the experimental system. These determinations have been made for the systems stated and for the isotopically reversed systems of DBr in H_2. CH_4, and C_2H_6. They indicate that the average probabilities of reaction per collision for the H atoms colliding with D_2, CD_4, and C_2D_6 are 0.18, 0.0034, and 0.919, respectively, while those for the reactions of the D atoms with the corresponding hydrogenated compounds are 0.35, 0.062, and 0.14. The ratio of actual energy loss per collision in this range to loss assuming elastic hard-sphere collisions is estimated to be about 1 for H + CD_4, 4 for H + C_2D_6, 2 for D + CH_4, and 4 for D + C_2H_6, based on the assumption that H + D_2 and D + H_2 moderating collisions are completely elastic. If these collisions are partially inelastic, both the estimated reaction probabilities and moderating efficiencies given above should be higher. (auth)

25562 KINETICS OF DIFFUSION-CONTROLLED PROCESSES IN LIQUIDS. THEORETICAL CONSIDERATION OF LUMINESCENT SYSTEMS: QUENCHING AND EXCITATION TRANSFER IN COLLISION. Juan Yguerabide, Michael A. Dillon, Milton Burton (Univ. of Notre Dame, Ind.). J. Chem. Phys., 40: 3040-52(May 15, 1964).

An examination of the effect of diffusion and locally inhomogeneous distributions on the over-all behavior of a system of reacting particles, both for steady-state conditions and for the decay (or relaxation) phenomena subsequent to creation of an initial condition, is presented. The problem is formulated for the quenching of excited molecules in solution in terms of diffusion equations for excited and quencher molecules with appropriate initial and boundary conditions. The diffusion equations are solved for a completely determined, but otherwise arbitrary, initial distribution of quencher molecules around an excited molecule and two sets of boundary conditions: the so-called Smoluchowski and "radiation" boundary conditions. The resultant equations give, in their turn, expressions for decay of excited molecules for initial random distributions following instantaneous excitation and, by the use of superposition integrals, for initial distributions following any form of excitation. Explicit expressions for the rise and fall of excited molecule concentrations result. The techniques are extendable in principle to a variety of essentially different processes. (auth)

25563 ANOMALOUSLY HIGH SPECIFIC RATES OF DIFFUSION-CONTROLLED REACTIONS: LUMINESCENCE QUENCHING IN LIQUID SYSTEMS. C. R. Mullin, M. A. Dillon, and Milton Burton (Univ. of Notre Dame, Ind.). J. Chem. Phys., 40: 3053-8(May 15, 1964).

Quenching constants (γ_0') and specific rates of quenching (k_q) of uv- and high-energy sensitized luminescence by carbon tetrachloride in de-aerated solutions of p-terphenyl in benzene and in cyclohexane are given. Values for k_q in benzene ranging as high as 3.6×10^{10} $\underline{M}^{-1}$ sec^{-1} appear, in first approximation, to be quantitatively explicable on the basis of current theoretical treatment. However, the cyclohexane results ($k_q > .3 \times 10^{11}$ $\underline{M}^{-1}$ sec^{-1}) are clearly anomalously high and are not suggested by current theory; some speculation as to the cause of such results is included. (auth)

25564 FLUORESCENCE AND ENERGY TRANSFER IN $Y_2O_3:Eu^{3+}$. J. D. Axe and P. F. Weller (IBM Watson Research Center, Yorktown Heights, N. Y.). J. Chem. Phys., 40: 3066-9(May 15, 1964).

Experimental evidence for nonradiative resonant energy transfer between Eu^{3+} and other trivalent rare-earth ions in Y_2O_3 is presented and possible interaction mechanisms are examined. It is concluded that coupling via overlap near zone quadrupolar fields is important. Measurements on the transient behavior of the Eu^{3+} fluorescence are also discussed. (auth)

25565 ESR STUDY OF A SINGLE CRYSTAL OF L-CYSTINE DIHYDROCHLORIDE IRRADIATED AT LOW TEMPERATURE. Kazuyuki Akasaka (Osaka Univ.) Shunichi Ohnishi, Tokuo Suita, and Isamu Nitta. J. Chem. Phys., 40: 3110-16(May 15, 1964).

An electron spin resonance study was made on free radicals produced in a single crystal of L-cystine dihydrochloride by irradiation at liquid-nitrogen temperature and on the process of their transformation during warming up to room temperature. The spectra showed remarkable anisotropy in g factor, whereas the hyperfine structures were almost isotropic. From the analysis of the spectra the following conclusion was drawn. The main primary radical produced at liquid-nitrogen temperature is the L-cystine dihydrochloride molecule with its S—S bond ionized probably to minus $[R-CH_2-S\text{-}S-CH_2-R]^-$. At −72°C, the ionized bond is unstable and is ruptured to form the "semistable" radical $R-CH_2-S\cdot$ in which the direction of the C—S bond as well as the electronic structure remains almost unchanged from those of the parent radical. At room temperature the radical further transforms into the stable free radical $R-CH_2-S\cdot$ in which the CH_2-S

group has rotated to a stable position accompanied by a change in the electronic state. The electronic structure for each radical is discussed in relation to the g factor analysis. (auth)

25566 RADIOLYSIS OF BINARY MIXTURES OF CYCLOHEXANE AND CYCLOHEXANE-d_{12} WITH BENZENE AND BENZENE-d_6. Thomas W. Lapp and John G. Burr (Atomics International, Canoga Park, Calif.). J. Chem. Phys., 40: 3130-1(May 15, 1964).

Data needed to evaluate the isotope effect in a possible quenching of excited cyclohexane molecules by benzene were obtained by measuring the yields and isotopic composition of the hydrogen from gamma irradiated solutions of benzene and benzene-d_6 in cyclohexane-d_{12}. The isotope effect at higher benzene concentrations was found to be a function of benzene deuteration and independent of cyclohexane deuteration. (R.E.U.)

25567 CHEMICAL STATES OF ^{32}P IN NEUTRON IRRADIATED POTASSIUM CHLORIDE. J. Cífka (Inst. for Nuclear Research, Czechoslovak Academy of Sciences, Rez). J. Inorg. Nucl. Chem., 26: 683-91(May 1964).

The distribution of ^{32}P atoms resulting from neutron irradiation of potassium chloride was studied. A higher percentage of ^{32}P atoms of lower valence was found in crystals doped with Ca^{2+} or Cd^{2+} ions. An oxidation occurs during the thermal annealing. A short initial period of reduction is characteristic of the doped crystals. (auth)

25568 OXYGEN BLEACHING OF GAMMA-RADIATION-INDUCED OPTICAL ABSORPTION BANDS IN POLYSTYRENE. L. A. Franks (Edgerton, Germeshausen & Grier, Inc., Goleta, Calif.). J. Polymer Sci., Pt. B, 2: 581-4 (June 1964).

Studies were made on the role of oxygen in the room-temperature bleaching of polystyrene in the region of 400 mμ. It was found that the bleaching was not uniform but progressed from the outer surfaces, maintaining a sharply defined boundary between the bleached and unbleached regions. It was concluded that the bleaching is the result of the reaction of diffused oxygen with absorbing entities and that its rate is diffusion-controlled. Owing to the dependence of the bleaching on the diffusion of oxygen, the process will necessarily be temperature-sensitive. (P.C.H.)

25569 INVESTIGATION OF THE RADIOCHEMICAL POLYMERIZATION OF POLYVINYL CHLORIDE. K. Posselt (Inst. of the Applied Physics of Pure Substances, German Academy of Sciences, Dresden). Monatsber. Deut. Akad. Wiss. Berlin, 6: 16-18(Jan. 1964). (In German)

For 50% polymerization of polyvinyl chloride a radiation dose of 80 to 90 Mrad was sufficient. The mechanical suppression, G modulus, Vicat temperature, density, and solubility in tetrahydrofuran of irradiated mixtures of polyvinyl chloride and triallylcyanurate were determined. The effects of triallylcyanurate concentration and radiation dose were studied. ^{60}Co served as the radiation source. (M.C.G.)

25570 ON THE AUTOXIDATION OF UNSATURATED FATTY ACIDS IRRADIATED WITH X RAYS IN THE EMULSION STATE. Yuichi Shinozaki and Sachiko Ohara (Okayama Univ., Japan). Okayama Daigaku Nogakubu Dojohiryogaku Hokoku, No. 20, 101-10(Sept. 1962). (In Japanese)

Changes of the physical and chemical characteristics of some unsaturated fatty acids during radioinduced autoxidation are described. Irradiation was carried out with 200-kv x-ray doses of 3000 r at 19 to 26°C on a 5-mm layer of fatty acid emulsion (20%, in water). It was found that under these conditions the free fatty acids are more sensitive than their esters. Greater amounts of peroxides are produced from the more unsaturated acids. Distinct differences were seen between conjugated and nonconjugated double bonds in their behavior to irradiation. Several unsolved problems were raised concerning the conjugated unsaturation of fatty acids which were accompanied by cis-trans isomerization or polymerization. Infrared spectra of various fatty acids before and after radioinduced oxidation are shown. (BBB)

25571 THE "PUZZLE" OF THULIUM LUMINESCENCE IN FLUORITE. M. N. Tolstoi and P. P. Feofilov. Opt. Spectry. (USSR) (English Transl.), 16: 206-7(Feb. 1964).

Experiments were performed to determine the thulium luminescence mechanism in calcium fluoride crystals. The crystals, which contained Tm^{3+} ions as an activator, were gamma irradiated at 77 and 4.2°K. It was found that the luminescence in the 1.8 – 2.0 μ region was that of Tm^{3+} sensitized by Tm^{2+}. (C.E.S.)

25572 THE GAMMA-IRRADIATION-INDUCED DECOMPOSITION OF AMIDES IN CARBON TETRACHLORIDE. Richard H. Wiley, R. L. S. Patterson, G. F. Chesnut, and E. Gruenhut (Univ. of Louisville, Ky.). Radiation Res., 22: 253-63(June 1964).

The irradiation of a variety of N-substituted amides at different concentrations in carbon tetrachloride was studied. Formamides and acetamides, N-unsubstituted, N-methyl, and N-phenyl types, undergo decomposition with the formation of hydrogen chloride (G = 8.46 to 23.29), chloroform (G = 0.24 to 1.23), hexachloroethane (G = 1.35 to 3.78), and tetrachloroethene (G = 0.16 to 1.67) in 5% solutions. The N-methyl structures are the source of the high yields of hydrogen chloride for which G values up to 106.21 have been observed with N,N-dimethylacetamide in 80% solutions with 8 hr of radiation at 1.4×10^5 rads/hr. Analysis of possible reaction paths leads to the conclusion that the N-chloromethyl structures are the source of the hydrogen chloride. (auth)

25573 RADIATION DAMAGE TO METHIONINE AND ITS DERIVATIVES. F. Shimazu, U. S. Kumta, and A. L. Tappel (Univ. of California, Davis). Radiation Res., 22: 276-87(June 1964).

The radiation lability of methionine and its derivatives was determined by measuring the half-reduction doses and formation of the major products. Increase in stability of methionine with higher oxidation states of the S atom was observed, and the degradation mechanisms of those amino acids are discussed. Mechanisms of radiation degradation of peptides containing methionine and protection mechanisms by methionine to glycine and alanine in their mixtures are discussed. (auth)

25574 ACTION OF GAMMA RADIATION ON LIQUID ETHYLENE GLYCOL. S. A. Barker, J. S. Brimacombe, and E. D. M. Eades (Univ. of Birmingham, Eng.). Radiation Res., 22: 357-67(June 1964).

The effects of γ radiation on liquid ethylene glycol were examined, and the products were determined by isotope dilution analysis. The mechanism of breakdown of ethylene glycol is discussed in the light of present-day theory. (auth)

25575 BASIC MECHANISMS IN THE RADIATION CHEMISTRY OF AQUEOUS MEDIA. PROCEEDINGS OF A CONFERENCE, GATLINBURG, TENNESSEE, MAY 8-10, 1963. Alvin Glassner and Edwin J. Hart, eds. Radiation Res., Suppl. 4, 1-223(1964). (CONF-81)

Fourteen articles are included; separate abstracts were

prepared for 9. Five articles previously abstracted in NSA as 18-20037, 17-33966, 17-39155, 17-32176, and 18-11627 include information on: radiation yields and reactions in dilute inorganic solutions; intensity effects, pulsed-beam effects, and the current status of diffusion kinetics; polyfunctional simple molecules of chemical interest; radiation chemistry of polymers; and basic mechanisms in the radiation chemistry of proteins and nucleic acids. (P.C.H.)

For abstracts of individual papers see: 25576, 25577, 25578, 25579, 25580, 25581, 25582, 25583, and 25584.

25576 THE FORMATION AND DETECTION OF INTERMEDIATES IN WATER RADIOLYSIS. Max S. Matheson (Argonne National Lab., Ill.). Radiation Res., Suppl. 4: 1-23(1964).

Studies were made on the mechanism of formation of intermediates, such as H_2, H_2O_2, H, OH, e^-_{aq}, and H_3O^+, in the radiolysis of pure liquid water. The use of light absorption for the detection of transient species in water is discussed. It was concluded that the hydrated electron reaction rate constants that were measured as well as the rate constants for other intermediates may be used to clarify the steps in the mechanism of water radiolysis. It is also evident that a more precise test of the diffusion kinetics model described is now possible. (P.C.H.)

25577 ADDENDUM: A CONJECTURE ON ELECTRON BINDING IN AQUEOUS SOLUTIONS. Joshua Jortner (Univ. of Chicago). Radiation Res., Suppl. 4, 24-34(1964).

Problems concerning the charge distribution and energy levels of the hydrated electron in aqueous solutions are discussed. Electron binding in metal solutions and models for electron binding in solutions are considered. It is demonstrated that the position and the intensity of the hydrated electron absorption band can be accounted for by application of the dielectric model in the self-consistent field version and utilization of the continuum properties of the medium for the limiting case $R_0 \rightarrow 0$. These conclusions are consistent with the hypothesis that the electron cavity size in water is expected to be much smaller than in liquid ammonia. An experimental test for the hypothesis that the size of the electron cavity in water is smaller than that in liquid ammonia can be obtained from the study of the temperature dependence of the position of the hydrated electron absorption band. Electron-trapping centers are also discussed. (P.C.H.)

25578 PULSED ELECTRON BEAM KINETICS. Hugo Fricke and J. K. Thomas (Argonne National Lab., Ill.). Radiation Res., Suppl. 4, 35-53(1964).

Radiolytic experiments in aqueous solutions with high-intensity pulsed electron beams provide a means of determining absolute rate constants for the interaction of primary and intermediate radicals with each other and with added scavengers. The experimental procedure involves studies of the effect on product yields of varying pulse length from times short compared with radical lives to times long compared with radical lives. The reaction kinetics is represented by a series of differential equations that cannot generally be solved analytically. General kinetic features of such systems when the reactions are homogeneous and bimolecular, numerical integration of the kinetic equations by machine computation, and theoretical analysis of some electron beam irradiations made with a linear accelerator and a Van de Graaff are considered. For a rectangular pulse, it is shown that product yields depend only on: yields of the different primary species; concentrations of reactive solutes of the solution relative to the concentration $[N_1]$ of a primary species produced during the pulse; rate constants of the different reactions relative to the value (k_{11}) for one of them; and the single parameter $\tau_1 = N_1 k_{11} t_1$, where t_1 is the length of the pulse. If τ_1 is so small that no appreciable reactions take place during the pulse and the solution contains only one reactive solute, the curve for any initial product yield plotted against the ratio of solute concentration to intensity of radiation is independent of intensity. The relative rate constants k_{OH+OH}/k_{H+H} and k_{H+OH}/k_{H+H} were determined from measurements of $G(H_2)$ at pH 3. Studies of reactions in solutions of H_2O_2 and O_2 provided thereafter the absolute rate constants for $H + H \xrightarrow{k_{11}} H_2$; $OH + OH \xrightarrow{k_{22}} H_2O_2$; $H + OH \xrightarrow{k_{12}} H_2O$; $H + H_2O_2 \xrightarrow{k_{13}} H_2O + OH$; $OH + H_2O_2 \xrightarrow{k_{23}} H_2O + HO_2$; $H + O_2 \xrightarrow{k_{15}} HO_2$; and $OH + HO_2 \xrightarrow{k_{24}} H_2O + O_2$ or H_2O_3. The method gives two determinations of rate constant values, one of which was excluded as unlikely on the basis of comparison with other methods. With $G_H = 3.3$, $G_{OH} = 2.7$, $g_{H_2} = 0.45$, and $G_{H_2O_2} = 0.75$, the following values were obtained, in terms of 10^{10} M^{-1} sec^{-1}: $k_{11} = 1.3$, $k_{22} = 0.6$, $k_{12} = 3.2$, $k_{13} = 0.016$, $k_{23} = 0.0012$, $k_{15} = 2.6$, and $k_{24} = 1.5$. (P.C.H.)

25579 A REVIEW OF THE RADIATION CHEMISTRY OF SINGLE-CARBON COMPOUNDS AND SOME REACTIONS OF THE HYDRATED ELECTRON IN AQUEOUS SOLUTION. Edwin J. Hart, J. K. Thomas, and S. Gordon (Argonne National Lab., Ill.). Radiation Res., Suppl. 4, 74-88(1964).

The radiation chemistry of single-carbon compounds is discussed by using the absolute rate constants and already established yields of intermediate species as a guide. Specifically, reactions of the hydrated electron, the H atom, and the hydroxyl radical with the components of irradiated water and with dissolved organic compound are dealt with. The compounds studied were methane, methanol, formaldehyde, formic acid, carbon monoxide, and carbon dioxide. Some reactions of organic molecules with the hydrated electron, e^-_{aq} are also discussed. (P.C.H.)

25580 EFFECTS OF OXYGEN AND pH IN THE RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS. J. H. Baxendale (Univ. of Manchester, Eng.). Radiation Res., Suppl. 4, 114-38(1964).

A general outline summarizing the main features of oxygen and pH effects in the radiolysis of aqueous solutions is given. The reactions of oxygen and yield effects of pH are discussed. 70 references are included. (P.C.H.)

25581 ADDENDUM: REDOX POTENTIAL AND HYDRATION ENERGY OF THE HYDRATED ELECTRON. J. H. Baxendale (Univ. of Manchester, Eng.). Radiation Res., Suppl. 4, 139-40(1964).

From previous data, the standard potential of the hydrated electron is added as a reducer to previous thermodynamic quantities for the hydrated electron. Calculations are given. (P.C.H.)

25582 ADDENDUM: THE RADIOLYSIS OF ACETONE IN AQUEOUS SOLUTIONS. Peter Riesz (National Cancer Inst., Bethesda, Md.). Radiation Res., Suppl. 4, 152-7 (1964).

The radiolysis of air-free aqueous acetone solutions was studied, the more important products were identified, and their G values were measured as a function of acetone concentration and pH. 2,5-Hexanedione, isopropanol, hydroxyacetone, hydrogen, and hydrogen peroxide were found to be major products, and traces of diacetone alcohol, pinacol,

and methane were also observed. The mechanism of pH effects is also discussed. (P.C.H.)

25583 ACTIONS OF IONIZING RADIATIONS ON NITROGEN COMPOUNDS IN AQUEOUS MEDIA. Warren M. Garrison (Univ. of California, Berkeley). Radiation Res., Suppl. 4, 158-74(1964). (UCRL-10827)

The radiolysis of ammonia, hydrazine, and hydroxylamine in aqueous solutions was studied. The reactions of OH, H, and e^-_{aq} with the nitrogen compounds and acidity effects are discussed. Mechanisms for the reactions are given. (P.C.H.)

25584 ADDENDUM: RADIOLYSIS OF AQUEOUS GLYCINE. Charles R. Maxwell (National Cancer Inst., Bethesda, Md.). Radiation Res., Suppl. 4, 175-8(1964).

Studies were made on the identification of additional products and the specific mechanism for the formation of certain products in the radiolysis of aqueous glycine. In addition to ammonia, methylamine, aspartic acid, DL-diaminosuccinic acid, and meso-α,β-diaminosuccinic acid, DL-erythro-β-hydroxyaspartic acid and DL-threo-β-hydroxyaspartic acid were also identified. Although no mechanism is proposed for the formation of the acids, it is believed that the scheme of formation as a secondary product by the addition of an electron to the carbonyl group of glyoxalic acid followed by neutralization and dimerization with the $NH_2CHCOOH$ radical can be ruled out. The yields in both acid and neutral solutions are independent of dose and unaffected by the addition of substantially large amounts of glyoxalic acid prior to irradiation. (P.C.H.)

25585 EFFECT OF DIVALENT IMPURITIES ON THE RADIATION STABILITY OF ALKALI-HALIDE CRYSTALS. M. I. Ignat'eva, E. K. Zavadovskaya, and I. Ya. Melik-Gaikazyan (Tomsk Polytechnic Inst., USSR). Soviet Phys.-Solid State (English Transl.), 5: 2031-4(Apr. 1964). (Translated from Fiz. Tverd. Tela, 5: 2775-9(Oct. 1963)).

A study was made of the dependence of the electrical conductivity, microhardness, lattice parameter, and absorption coefficient at the F-band maximum on the lead content in KBr, and of the radiation-induced changes of the electrical conductivity and microhardness. After x-ray irradiation ($\approx 6 \times 10^4$ R), the electrical conductivity of KBr at 60°C increased by a factor of 4 and that of KBr + 0.6×10^{-3} mol. % Pb^{2+} increased by a factor of 20. (auth)

25586 LUMINESCENCE OF KNO_3 IRRADIATED WITH γ RAYS. Yu. A. Kulyupin and A. F. Yatsenko (Inst. of Physics, Kiev). Soviet Phys.-Solid State (English Transl.), 5: 2443-5(May 1964). Translated from Fiz. Tverd. Tela, 5: 3334-6(Nov. 1963).

The luminescence of NO_2^- impurities induced in KNO_3 by gamma irradiation was investigated to determine whether it is due to the glow of local centers or to exciton annihilation. The specimens were irradiated at room temperature, and the dose rate varied between 0.4 and 170 Mrad. (C.E.S.)

25587 EFFECT OF DEUTERIUM IODIDE AND HYDROGEN BROMIDE ON THE PHOTO-OXIDATION OF METHYL IODIDE. J. Farren, J. R. Gilbert, J. W. Linnett, and I. A. Read (Inorganic Chemistry Lab., Oxford). Trans. Faraday Soc., 60: 740-50(Apr. 1964).

The photooxiadtion of methyl iodide was studied using a mass spectrometer. The radical intermediates were inferred by scavenging with deuterium iodide and hydrogen bromide. From the results obtained a mechanism was proposed for the oxidation of methyl radicals via the methyl peroxy radical. (auth)

25588 ELECTRON SPIN RESONANCE STUDIES OF γ-IRRADIATED OLEFINS AND u.v.-IRRADIATED METHYL IODIDE + OLEFIN GLASSES. P. B. Ayscough and H. E. Evans (Univ. of Leeds, Eng.). Trans. Faraday Soc., 60: 801-8(May 1964).

Gamma irradiation of solid olefins at −196°C results in the trapping of a variety of paramagnetic species that were identified by means of electron spin resonance observations. On the basis of this evidence it is suggested that the main reaction of the primary molecule-ion formed from straight-chain terminal olefins is addition to a neighboring molecule: for almost all other olefins it seems likely that proton transfer takes place, leaving an allylic radical. Some preliminary observations on the uv photolysis of methyl iodide in solid olefins are also reported. (auth)

25589 MECHANISM OF HYDROGEN FORMATION IN THE RADIOLYSIS OF LIQUID ETHANOL. G. E. Adams and R. D. Sedgwick (Centre d'Etudes Nucleaires, Saclay, France). Trans. Faraday Soc., 60: 865-72(May 1964).

The γ radiolysis of liquid ethanol was studied with particular emphasis on the mechanism of hydrogen formation. In the pure material the products are H_2, CH_4, C_2H_6, C_2H_4, CH_3CHO, and vic-glycol. The effect of solutes on $G(H_2)$ and in some cases other yields was investigated. In pure de-aerated ethanol $G(H_2) = 4.85$; however, in the presence of many solutes of widely differing chemical structures, $G(H_2)$ decreases with increasing concentration attaining finally the molecular yield of 1.65. The experimental curves generally show an inflection at which $G(H_2) = 3.90$ and is independent of solute concentration. The results were interpreted in terms of the reactions of two primary reducing species each of which normally leads to hydrogen formation. These precursors are the H atom and the solvated electron formed with initial yields, $G(\dot{H}) = 2.25$ and $G(e^-) = 1.02$, respectively. In acidified ethanol $G(H_2)$ increases, and solute scavenging efficiency decreases. This was interpreted in terms of the reactions of the species $C_2H_5OH_2^+$ analogous to H_3O^+ present in aqueous systems. (auth)

25590 ALPHA RADIOLYSIS OF AQUEOUS SOLUTIONS. M. V. Vladimirova. Usp. Khim., 33: 462-76(Apr. 1964). (In Russian)

A review is given of the early methods of radiolysis and of up-to-date methods using Po prepared by neutron irradiation of bismuth ($^{209}Bi + n_0 \rightarrow {}^{210}Bi \xrightarrow{\beta} {}^{210}Po$). Alpha sources of Po, Rn, Pu, Am, Cm, and Np are also described. The radiolysis of water and of aqueous solutions of sulfuric acid, the radiolysis of organic and inorganic aqueous solutions and the mechanism of α radiolysis are discussed. 82 references. (R.V.J.)

25591 BEHAVIOR OF UNSATURATED FATTY ACIDS AND LIQUID ORGANIC COMPOUNDS IN A GAMMA-RAY FIELD. Kazuta Kitahara and Yoshimasa Tanaka (Univ. of Kumamoto, Japan). Yakugaku Zasshi, 83: 203-6(Feb. 1963). (In Japanese)

Physical and chemical changes in organic compounds, especially unsaturated fatty acids, caused by high-dosage γ radiation from a 16,000-C source were studied. Changes resulting from irradiation were examined by gas chromatography and by infrared absorption spectra. Electric conductivity during irradiation was measured by a special measuring cell possessing a wide electrode area; its construction is described. No change was observed in unsaturated fatty acid esters of 18 carbon atoms when irradiated with the dose of about 10^6 r, in an oxygen-free state.

Electric conductivity during the irradiation was found to be proportional to the square root of dose rate at a constant temperature, within a range of dosage rate of 10^4 to 10^6 r/hr, but the conductivity returned to the preirradiation level within a few hours upon removal of the irradiation source. This finding may be of interest for clarification of the chemical reaction under γ irradiation and also may be useful for measuring a high dosage rate. (BBB)

25592 ON THE RADIOLYSIS OF O- AND M- DICHLORBENZENES. J. Wendenburg (Hahn-Meitner-Institut für Kernforschung, Berlin). Z. Naturforsch., 19b: 187-91 (Mar. 1964). (In German)

Hydrogen chloride, chlorobenzene, various isomers of trichlorobenzene as well as different oligomers were found to be formed in the gamma radiolysis of liquid o- and m-dichlorobenzene. The results are explained in terms of a mechanism, which was earlier developed for the radiation chemistry of chlorobenzene. The oligomers of chain lengths larger than two could be separated in the case of o-dichlorobenzene and roughly be fractionated. Chain lengths of more than 4 were found to be present. Iodine inhibited the formation of the oligomers. In the case of 1.2.4-trichlorobenzene hydrogenchloride, the various isomers of dichlorbenzene and tetrachlorobenzene were formed and a product of presumable higher molecular weight could be separated by methanol. (auth)

25593 RADIOCHEMICAL CHANGE OF 6-HALOGEN-URACIL IN DNA UV RADIATION. Hanswerner Dellweg and Adolf Wacker (Universität, Frankfurt am Main). Z. Naturforsch., 19b: 305-11(Apr. 1964). (In German)

After cultivation of Enterococcus Stei with ^{14}C-labeled 5-chloro-, 5-bromo-, or 5-iodo-uracil, the DNA was isolated from the cells and highly purified. By UV irradiation of this DNA in aqueous solution the incorporated 5-halogenuracil was changed photochemically. On decomposition of this irradiated DNA, in addition to small amounts of nonidentified photo-products, predominantly uracil was found after hydrolysis of the radiation products with perchloric acid and after fermentative decomposition of uracildesoxyriboside. The dehalogenation of the bromouracil and iodouracil in the DNA occurred somewhat more rapidly with dependence on the irradiation intensity, while chlorouracil was dehalogenized much more slowly. The photochemical dehalogenation of bromouracil took place easily in untreated DNA, less well in heat-denatured DNA, and only in small amounts in apurin acid. (tr-auth)

25594 THE POLARIZATION OF THE FLUORESCENCE OF ORGANIC SCINTILLATION CRYSTALS BY EXCITATION WITH α RADIATION. Joachim Kayser (Universität, Göttingen, Ger.). Z. Physik, 178: 445-56(1964). (In German)

The polarization of the fluorescence spectra of the organic scintillation crystals naphthalene, anthracene, terphenyl, quaterphenyl, and stilbene was measured by excitation with α particles. The measurements were carried out with thin crystal plates of different crystallographic orientation and for different angles of incidence of α particles. Careful experiments showed that the polarization values of anthracene do not depend on the angle of incidence of α particles. A model is proposed for explaining the results and the polarization values are discussed and compared with corresponding values of uv investigations. (auth)

25595 RADIOCHEMICAL BEHAVIOR OF TRIPHENYLTETRAZOLIUM CHLORIDE. Erwin Winter (Bundesforschungsanstalt für Lebensmittelfrischhaltung, Karlsruhe). Z. Physik. Chem. (Frankfurt), 40: 109-22(Jan. 1964). (In German)

The behavior of triphenyltetrazolium chloride under x-ray irradiation was investigated. Effects of pH, buffer, concentration, evaporation, radiation intensity, radiation dose, exchange, oxygen, hydrogen peroxide, and the triphenylformazan produced the reactions induced by the radiation were determined. The yield of triphenylformazan was proportional to dose up to 18000 kr. The G value amounted to 0.22. (M.C.G.)

25596 THE CHEMICAL EFFECTS OF THE Br^{80m} $\xrightarrow{I.T.}$ Br^{80} AND $Br^{81}(n,\gamma)Br^{82}$ NUCLEAR TRANSFORMATIONS IN CONDENSED ORGANIC MEDIA. Rolf Mathieu August Hahne. Thesis, Madison, Wis., Unif. of Wisconsin, 1964. 140p.

Chemical effects of the nuclear transformations ^{80m}Br $\xrightarrow{I.T.}$ ^{80}Br and $^{81}Br(n,\gamma)^{82}Br$ have been studied in the solid and liquid phases in organic systems. In the solid phase at 77°K, significant differences have been found between glassy and polycrystalline alkyl bromides with molecular bromine present. For those solids in which most or all of the activated bromine atoms were originally in organic combination, the organic yield was found to be higher for the crystal than for the glass; the reverse was true when the hot bromine atoms were originally in molecular bromine. For solids in which the decay of $Br^{80m}Br$, produced the hot atoms, the organic yields in the polycrystalline state were essentially unchanged from 0.02 mole % to 10 mole % Br_2, and the organic yields in the glassy state were only moderately reduced by increasing bromine concentration. For solids containing 1-$C_4H_9{}^{80m}Br$, the organic yields in the polycrystalline state were decreased about 2.5% by the addition of 0.5 mole % Br_2, while those in the glassy state were reduced nearly ten times as much by the addition of the same concentration of Br_2. For solid systems in which the $^{81}Br(n,\gamma)^{82}Br$ process produced the recoil atoms, the organic yields in both the polycrystalline and glassy systems were found to be sensitive to bromine concentration; those for the glass were reduced by about 22% by the addition of 0.08 mole % Br_2 while those for the crystal were reduced roughly 6% by the addition of the same amount of Br_2. Oxygen concentration and temperature have been shown to have some influence on some of the organic yields resulting from the ^{80m}Br $\xrightarrow{I.T.}$ ^{80}Br process. The major effects summarized above are hypothesized to be due to differences in the initial energy of the activated bromine atoms and to differences in the solid structure, which alter the recoil atoms' range. Gas chromatographic analyses of the various radioactively tagged organic products formed in 1-bromopropane : bromine systems as a result of $Br^{80m}Br$ decay give considerably different product distributions for the liquid, glass, and polycrystalline states, and for polycrystalline solids with different bromine concentrations. E.S.R. studies of gamma-irradiated 1-bromobutane : bromine solids at 77°K have indicated that the glassy and polycrystalline solids have considerably different radical-trapping ability and thermal annealing behavior. Temperature has been shown to have a significant effect on the organic yield of liquid 1-bromopropane : $Br^{80m}Br$ solutions; this effect is attributed primarily to differences in caging at different temperatures. Studies of the ^{80m}Br $\xrightarrow{I.T.}$ ^{80}Br and $^{81}Br(n,\gamma)^{82}Br$ processes have been done with unscavenged and bromine-scavenged solutions of alkyl bromides in alkanes, in attempting to extend the "Auger Electron Radiation Hypothesis" to alkane-alkyl bromide solutions. The behavior predicted by the hypothesis was not observed pos-

sibly due to a low probability of dissociative electron capture of the alkyl bromide solute and/or competition of Br_2 with the alkyl bromide for the electrons available. (Dissertation Abstr.)

25597 GAS PHASE PHOTOCHEMICAL REACTIONS AND REACTIONS OF PHOTOCHEMICALLY PRODUCED HOT HYDROGEN ATOMS INITIATED BY 1850 Å RADIATION. Richard McKelvy Martin. Thesis, Madison, Wis., Univ. of Wisconsin, 1964. 225p.

Three problems are treated as follows: the photochemistry of methyl iodide and the photochemically induced exchange of iodine atoms between methyl iodide and iodine, the photochemistry of hydrogen iodide, and reactions of hot hydrogen atoms produced by the photolysis of hydrogen bromide. The methyl iodide study was undertaken primarily to determine the quantum yield for the exchange of iodine atoms between methyl iodide and iodine initiated by 1850 Å light. The system studied has been used previously as an actinometer for 1850 Å, assuming an exchange quantum yield of unity. In the present work it was concluded that the quantum yield for exchange, assuming no other reactions occur, is 0.85 ± 0.1. I_2 was however found to disappear with a quantum yield of about 0.3. This, together with the results of a methyl iodide photolysis experiment in which the production of both methylene iodide and hydrogen were indicated, suggests that molecular elimination reactions to form hydrogen and/or hydrogen iodide occur with methyl iodide following absorption of 1850Å radiation. The purpose of the hydrogen iodide study was to determine the quantum yield for hydrogen and iodine production. Previous results in this laboratory had indicated that the quantum yield in the 1850Å region might be significantly greater than unity, suggesting a secondary HI decomposition by the energetic hydrogen atoms which are produced in the primary dissociation. The conclusion of the present work is that the quantum yield is in the region 1.1 ± 0.1. The work with hydrogen bromide was undertaken to study reactions of the 3 ev hydrogen atoms produced in the primary decomposition. The systems $HBr-D_2$, $HBr-CD_4$, $HBr-C_2D_6$, $DBr-H_2$, $DBr-CH_4$, and $DBr-C_2H_6$ were photolyzed over a range of HBr/RD or DBr/RH ratios and the product ratio H_2/HD or D_2/HD was determined as a function of reactant ratio. Plots of product ratio vs reactant ratio were linear with non-zero intercepts in all cases. Average relative reaction probabilities per collision were obtained from the slopes and the total hot atom reaction probabilities in pure RH or RD were determined from the intercepts. The latter values ranged from 0.06 for H + CD_4 to 0.6 for H + D_2 and D + H_2. Values for the average hot atom reaction probability per collision and the average fraction of hot atom energy lost per nonreactive collision have been calculated for all the systems, assuming elastic moderation for H + D_2 and D + H_2 collisions. Average reaction probabilities for H with D_2, CD_4, and C_2D_6 were 0.18, 0.003, and 0.019 whereas those for D with H_2, CH_4, and C_2H_6 were 0.35, 0.062, and 0.14, respectively. Collisions of D with CH_4 and C_2H_6, and of H with C_2D_6 appear to be quite inelastic, whereas H + CD_4 collisions seem to have little inelastic character in the energy region studied. (Dissertation Abstr.)

25598 THE RADIOLYSIS OF NORMAL AND SECONDARY BUTYL CHLORIDE. Richard Corth. Thesis, Brooklyn, Polytechnic Inst. of Brooklyn, 1963. 109p.

A study was made of the radiation chemistry of the normal and secondary butyl chlorides subjected to 40, 45, and 50 kv x rays. The anhydrous compounds were irradiated in the liquid state in vacuo. Water was added to some samples and oxygen to others. In addition, n-butyl chloride was irradiated in the solid state at −196°C. A study was also conducted of the effect of dose rate on the hydrogen chloride yield of n-butyl chloride. The major products found were hydrogen chloride, butene and/or other unsaturated products, and hydrogen. Infrared studies showed the possible presence of carboxyl groups in the products of n-butyl chloride irradiated in the presence of water. Only a trace of a five carbon hydrocarbon was observed in the mass spectrum of irradiated n-butyl chloride. Some three carbon hydrocarbons were noted along with a preponderance of four carbon hydrocarbons, both being largely unsaturated. No chlorine was found as a radiolytic product. The yield of chloride was considerably enhanced in the presence of water and oxygen. In vacuo, a marked dose rate effect was observed, the G value for chloride decreasing with increasing dose rate. The G value in vacuo, for hydrogen chloride yield in the normal compound varied from 0.57 to 1.0, when the dose rate was varied from 5.5×10^{16} ev/sec/g to 0.6×10^{16} ev/sec/g, respectively. At a dose rate of 2.8×10^{16} ev/sec/g the following G values for chloride yield were obtained:

s-butyl chloride, in vacuo	0.99 ± 0.02
n-butyl chloride, saturated with water	5.4 ± 0.2
s-butyl chloride, saturated with water	6.1 ± 0.1
n-butyl chloride, in vacuo	0.76 ± 0.01
n-butyl chloride, in presence of oxygen	1.46 ± 0.01
n-butyl chloride, crystalline, at −196°C	0.24 ± 0.01

The G value for the yield of unsaturation for n-butyl chloride in vacuo, at the same dose rate, was 0.69 ± 0.01. A back reaction mechanism is proposed which accounts for the dose rate effect and the enhanced yield of hydrogen chloride from the irradiation in the presence of water and oxygen, and which accounts for the low yield in the irradiation at −196°C. The mechanism takes into account the diffusion of products from the radiation volume, the rate at which products are formed, and the competition of oxygen and water for unsaturated radiolysis products. (Dissertation Abstr.)

25599 THE PHOTO-CHEMICAL AND THERMAL REACTIONS OF DYSPROSIUM IN CALCIUM FLUORIDE. Francis K. Fong (RCA Labs., Princeton, N. J.). 25p. (CONF-405-21)

From 4th Rare Earth Research Conference, Phoenix, Ariz., Apr. 1964.

Trivalent Dy ions doped in CaF_2 were reduced by γ radiation at room temperature. The efficiency of reduction of Dy^{+3} in CaF_2 is described in terms of the dosage of γ radiation and concentration of the dopant ions. It was found that divalent Dy ions obtained at high dosages of γ irradiation are relatively unstable. Re-oxidation by visible light occurs in a stepwise manner, the rate becoming progressively slow with time, and appears to be a first-order reaction. Thermal oxidation of the reduced Dy ions occurs readily at temperatures above the room temperature, the rate becoming extremely rapid at temperatures above 155°C. Emission of intense white light accompanies the oxidation, and the emission spectrum observed resembles strongly the photo-emission spectrum of the trivalent Dy ions. Thermal oxidation apparently follows a different route from the corresponding photochemical process as the decay of the emission lines observed in thermal oxidation is nonexponential, and the reaction kinetics fit the description of a second-order reaction. The mechanisms of these processes are discussed in some detail. (auth)

25600 IRRADIATION VAULT. Fred Maud and Thomas Horne (to Budd Co.). U. S. Patent 3,132,251. May 5, 1964. Filed Oct. 27, 1960.

An irradiation vault in which large radioactive sources may be stored and in which objects can be exposed to large doses of radiation is described. The exposure chamber and radiation source are both moveable. The radiation source is moved to a safe position during loading and automatically returned to the exposure chamber when the loading is completed. (C.E.S.)

25601 CHEMICAL RADIATION INSTALLATION. D. M. Torgovitskii, V. L. Karpov, A. Kh. Breger, M. E. Eroshov, B. I. Vaynshteyn, N. P. Syrkus, V. E. Drozdov, G. N. Lisov, and S. G. Stoyenko. USSR Patent 160,236.

A chemical radiation installation intended for carrying out radiation studies on a large scale is described. The installation contains a working chamber in which the reception of all kinds of objects takes place, a pit for storage of radiation sources, an operator's room for remote control of all working-chamber processes, and equipment for purification of the water from radioactive pollution. Not only can all kinds of radioactive isotopes be used as radiation sources, but also the heat-liberating elements of many reactors. This is made possible by a storage cartridge located in the pit; it has the form of a sectionalized ring with receptacles for vials containing the radiation sources. The sections of the ring are separated by cadmium partitions that absorb neutrons, preventing them from multiplying and starting a chain reaction. External dry loading and unloading of the radiation sources, without bringing the container into the working chamber or submerging it in the water, is accomplished by equipping the loading device with a monorail trolley that removes the container from the truck and a receiving unit with a rotating frame. This unit is lowered by the trolley in such a way that the axis of the container coincides with the axis of the inclined loading channel, after which a flap in the loading channel is opened and the container plug and the vial are lowered into the pit, where they are placed in a receptacle of the storage cartridge by a grappling device. (AID Press Vol. 2, No. 226, May 1964)

Separation Processes and Procedures

25602 (AERE-R-4583) CHROMATOGRAPHIC METHODS FOR THE SEPARATION OF NITRATO- AND NITRO-COMPLEXES OF NITROSYLRUTHENIUM. D. Scargill (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Apr. 1964. 19p.

Methods are described for the separation of the individual nitrato and dinitro complexes of RuNO(III) and the determination of the proportions of nitrato (group D) and dinitro-complexes in mixtures of these complexes, which are subject to solvent extraction in aqueous nitric acid solutions, by means of reversed-phase paper chromatography. The chromatographic techniques formerly used were modified to give good separation of the extractable from the relatively inextractable complexes. Two dinitro complexes, one of which was cationic, were identified by cation exchange methods. The presence of a mononitro-mononitrato complex was indicated. The results showed that the tetranitrato-complex is more extractable by tri-n-butylphosphate than the trinitrato-complex. (auth)

25603 (CEI-18) THE EXTRACTION OF PLUTONIUM WITH TRIETHYLENE GLYCOL DICHLORIDE. A. M. Aikin, M. Moss, and T. Bruce (Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.). Mar. 31, 1951. 17p. (CPP-29; AECL-1786)

The extraction of plutonium by triethylene glycol dichloride (trigly) was investigated briefly. The effects of (1) the valence state of the plutonium, (2) the concentration of nitric acid, (3) the concentration of ammonium nitrate, and (4) the conditioning of the trigly were measured. The solubility of plutonium(IV) in trigly was found to be 70 mg/ml. Solutions of plutonium in trigly and in concentrated nitric acid solutions were examined spectrophotometrically. (auth)

25604 (CRC-487) EXTRACTION OF PLUTONIUM BY HEXONE FROM AQUEOUS SOLUTIONS CONTAINING NITRIC ACID. D. R. MacKenzie (Atomic Energy of Canada Ltd., Chalk River, Ont.). Dec. 4, 1951. 47p. (AECL-1787)

A general study was made of the chemistry of plutonium-hexone systems containing nitric acid. The greater part of the work consisted of investigating the extent to which hexone extracted plutonium from aqueous solutions. A study of aqueous Pu(III) solutions in contact with hexone showed that the small amount of plutonium appearing in the hexone phase was in the tetravalent state. The partition coefficients for pure Pu(IV) and Pu(VI) were determined under a variety of conditions in aqueous-hexone systems containing no salting-out agent, and containing the salts ammonium, zinc, aluminum, and uranyl nitrate. A necessary preliminary to these studies was the preparation of plutonium in pure valence states, and the determination of the absorption spectra of these states in aqueous and hexone solutions of different acidities. The decomposition of hexone under the chemical influence of dissolved plutonium was observed and investigated in a qualitative manner. (auth)

25605 (DP-882) EVALUATION OF n-PARAFFIN MIXTURES AS DILUENT FOR TBP IN RADIOCHEMICAL SEPARATIONS PROCESSES. Richard N. Wilhite (Du Pont de Nemours (E. I.) & Co. Savannah River Plant, Aiken, S. C.). Apr. 1964. Contract AT(07-2)-1. 32p.

Samples of n-paraffin mixtures were evaluated to determine their suitability for use as diluent for TBP in solvent extraction processes. The n-paraffin mixtures were produced by separating n-paraffins from petroleum with urea or with molecular sieves or by hydrogenating normal α-olefins. The n-paraffin mixtures from sieve processes or from the hydrogenation of normal α-olefins were found to be the most suitable commercial products based on purity, stability, and price. (auth)

25606 (ORNL-3585) PROPOSED HEAD-END TREATMENTS OF PUREX-1WW WASTE FOR FISSION PRODUCT RECOVERY BY ION EXCHANGE. W. C. Yee and W. Davis, Jr. (Oak Ridge National Lab., Tenn.). June 1964. Contract W-7405-eng-26. 35p.

Two methods are described for preparing Purex 1WW radioactive waste for recovering strontium and/or rare earths by cation exchange. One method involves complexing the major cationic impurities with citrate ion at pH 2.5, and processing a twentyfold diluted and treated waste solution through a column of resin (pre-equilibrated to pH 2.5 with ammonia) where the uncomplexed alkaline earth and rare earth elements are sorbed. The other method involves precipitating sulfate ion (as ferric sulfate) from Purex 1WW waste at 55 to 60% HNO_3, and precipitating

strontium nitrate from the resulting nearly-sulfate-free solution from 85% HNO_3. Cation exchange is used to purify this precipitate further. Pretreatment (complexing) with citrate ion results in a fourfold and threefold improvement in resin capacity for strontium and rare earths, respectively, over that for untreated and tenfold diluted waste. Less than 1% of the ferric ion in the waste is sorbed on the resin. Pretreatment by a double precipitation concentrates the strontium by a factor of 2.5 to 3.0 and reduces by more than 200-fold the ratio of total trivalent cationic impurities to strontium. Resin capacity for strontium is improved by a factor of 20 over that for the citrate-treated waste. Radiation degradation of the resin in both processes is discussed in terms of expected resin life. If citrate complexing is used as the basis for separating strontium and/or rare earth elements from impurity ions, then operating time to 10% resin capacity loss would be about 2500 hr or 100 hr, depending on whether just strontium or strontium and rare earth elements were recovered. If the head-end precipitation process is used for removing impurities, then the time to 10% loss of resin capacity in the final purification would be only about 15 and 10 hr, respectively, depending on whether strontium or strontium and rare earth elements were recovered. (auth)

25607 (ORNL-3633) ORNL RADIOISOTOPES PROCEDURES MANUAL. D. A. Fuccillo, Jr. and Sylvia B. Ewing, comps. (Oak Ridge National Lab., Tenn.). June 1964. Contract W-7405-eng-26. 217p.

The procedures used in the chemical processing of neutron-produced and short-lived fission product radioisotopes are described. Target selection, target preparation, reactor irradiation principles, and processing principles are discussed. Detailed procedures for each radioisotope are presented. The storage and shipping operations are described. Appendices include descriptions of the Oak Ridge Research Reactor and the chemical processing facilities, tabulated reactor production data for each isotope product analytical techniques, and bibliography. (M.C.G.)

25608 (ORNL-TM-867) DISSOLUTION OF SOL-GEL-DERIVED AND ARC-FUSED ThO_2–UO_2 FUEL PARTICLES IN HNO_3–HF SOLUTIONS: LABORATORY STUDIES. L. M. Ferris and J. W. Ullmann (Oak Ridge National Lab., Tenn.). May 19, 1964. Contract W-7405-eng-26. 18p.

Dissolution, in nitric acid solutions containing small amounts of HF and $Al(NO_3)_3$, of ThO_2—4% UO_2 powders prepared primarily by the sol-gel process was investigated briefly. Tests with both unirradiated and irradiated samples from three sources (sol-gel, arc-fused, and pelletized) showed that the mixed oxide can be dissolved in boiling Thorex reagent (13M HNO_3—0.04M HF containing up to 0.1M $Al(NO_3)_3$). With unirradiated sol-gel samples (60%, −10 +16 mesh; 15%, −50 +140 mesh; 25%, −200 mesh), 70 to 73% dissolved in 7 hr (the solutions would have been 1M in thorium if all the oxide dissolved). Complete dissolution required about 75 hr under the same conditions. All types of irradiated samples [burnups of 4000 to 40,000 Mwd/metric ton (U + Th) and heat ratings of 17,000 to 45,000 Btu $hr^{-1}ft^{-1}$] appeared to react much faster, at least initially. In 7-hr tests, under essentially the same conditions used for the unirradiated samples, about 95% of the irradiated oxide dissolved. Based on cyclic experiments with unirradiated oxide, dissolution using the "heel" technique appears feasible. Optimum conditions for heel dissolution were not determined. However, the heel was about 13% when the dissolution time was 20 hr per cycle and the thorium concentration in solution was 0.8M. Under these conditions, steady-state operation was achieved in about two cycles. The heel is defined as the percentage of the oxide present at the start of a cycle that is not dissolved during that cycle. (auth)

25609 (RCC-M-173) AN APPARATUS FOR MICRO-SCALE LIQUID-LIQUID EXTRACTIONS. W. H. Thornett (United Kingdom Atomic Energy Authority. Research Group. Radiochemical Centre, Amersham, Bucks, England). Apr. 1964. 4p.

An apparatus is described for solvent extraction on a micro-scale. A plunger-type syringe is employed for both mixing and separating the phases, and the apparatus is suitable for all solvents. (auth)

25610 (SGAE-CH-4/1964) ANALYSE VON NUKLEAREN BRENNSTOFFEN. 1. AUFLOSUNG VON BESTRAHLTEN URANPROBEN. (Analysis of Nuclear Fuel. 1. Dissolution of Irradiated Uranium Samples). H. Sorantin, H. Bildstein, N. Getoff, V. Pfeifer, and H. Titze (Österreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf, Austria). Mar. 1964. 17p.

An apparatus for the dissolution of uranium fuel samples is described. Activity curves for an irradiation time of eight days are shown for the different bromine, krypton, xenon, and iodine isotopes. Dissolving media for uranium metal, uranium oxides, and U–Mo-alloys are cited as well as for such canning materials as Al, Mg, and stainless steel. Absorption of fission gases and decontamination procedures are discussed. (auth)

25611 (AEC-tr-6227/1(p.1-8)) THE SEPARATION OF URANIUM FROM SOME CATIONS ON A COLUMN WITH A 4A-TYPE MOLECULAR SIEVE AS AN ION EXCHANGER. M. V. Šušić, V. M. Radak, D. S. Veselinović, and N. A. Petranović. Translated from Bull. Boris Kidrich Inst. Nucl. Sci., 15: No. 1, 1-8(1964).

The adsorption and elution of uranyl ions and ions of other metals on a column filled with a 4A-type molecular sieve as an ion exchanger were investigated. It was shown that by eluting the column with an oxalate solution, and in particular with ascorbic acid solutions, uranium can be separated from a series of cations. (auth)

25612 (ORNL-tr-128) THIN LAYER IONOPHORESIS OF INORGANIC MATERIALS AT LOW AND HIGH VOLTAGE WITH THE USE OF RADIONUCLIDES. A. Moghissi. Translated by J. J. Pinajian (Oak Ridge National Lab., Tenn.), from Anal. Chim. Acta, 30: 91-5(1964). 8p.

Thin-layer ionophoresis was used for separating inorganic substances. Separations were carried out at 13 or 45 v/cm using radionuclides. The equipment used is described. High-voltage ionophoresis was conducted either under cooling conditions or in an atmosphere of water vapor. Migration times under these conditions were 2 or 5 min, respectively. (auth)

25613 SEPARATION OF SCANDIUM FROM YTTRIUM, LANTHANUM, AND THE RARE EARTHS BY CATION EXCHANGE CHROMATOGRAPHY. F. W. E. Strelow and C. J. C. Bothma (South African Council for Scientific and Industrial Research, Pretoria). Anal. Chem., 36: 1217-20 (June 1964).

Scandium is separated from Yt, La, Ce, Sm, Er, and Yb by cation exchange chromatography. The Sc is eluted from a column of AG 50W-X8 resin with 2N sulfuric acid while the rare earths are retained. The rare earths can then be eluted with 4N hydrochloric acid. Results of quantitative separations are reported for two different column sizes: 0.377 mg of Sc could be separated quantitatively from

443.6 mg of La or from 288.4 mg of Yb, and 150.8 mg of Sc from 0.887 mg of La. Flow rates are critical, especially for the smaller columns. The procedure should also separate Sc from the rare earths not named. (auth)

25614 SEPARATION OF VARIOUS CATIONS BY REVERSED-PHASE PARTITION CHROMATOGRAPHY USING NEUTRAL ORGANOPHOSPHORUS COMPOUNDS. Jerome W. O'Laughlin and Charles V. Banks (Ames Lab., Ames, Iowa). Anal. Chem., 36: 1222-9(June 1964). (IS-784)

The use of the neutral organophosphorus compounds tri-n-butylphosphate (TBP), tri-n-octylphosphine oxide (TOPO), and bis(di-n-hexylphosphinyl)methane (HDPM) as stationary phases in the reversed-phase partition chromatography of various metal chlorides, nitrates, and perchlorates was investigated. R_f and R_r values are reported as a function of the acid concentration of the mobile phase for the movement of a large number of cations on paper impregnated with TBP, TOPO, or HDPM. Elution curves are also given for several alkali metal and alkaline earth perchlorates on columns packed with Kel-F treated with these three extractants. (auth)

25615 SEPARATION OF P^{32} FROM SULFATES IRRADIATED IN A REACTOR. Marcello Bresesti, Renato Lanz, and Anna Maria del Turco (EURATOM, Ispra, Italy). Ann. Chim. (Rome), 53: 1411-20(Oct. 1963). (In Italian)

The separation of ^{32}P from metal sulfates after reactor irradiation is discussed. Separation was achieved on an alumina column with loss from absorption on the glass minimized by treatment with silicone treatment of the glass by the method of Rubin (Science, 110: 425(1949)). The alumina were converted to the chloride form, and optimum yields were achieved in the pH range 4 to 7. In strong acid the absorption was lower. Alumina in the hydroxide form is useful for the separation of ^{32}P from K_2SO_4 and $(NH_4)_2SO_4$. Fractional elution of sulfates and carrier-free ^{32}P was accomplished by removal of sulfates with NH_4OH solution of pH 10 (large volume, no ^{32}P removed) or with NH_4OH solution of pH 10.5 (50 ml, 0.5% ^{32}P removed). Solutions of NaOH (0.5N) then were used to removed ca. 95% of the ^{32}P (70 ml at room temperature, 50 ml at 70°C). Removal of ^{35}S from the column may be achieved by washing with small amounts of sulfate solution. Cations could be removed by the the use of acid from Amberlite IR-120 column. These results disagree with those of Veljković and Milenković (Bull. Inst. Nucl. Sci. "Boris Kidrich," 10: 61 (1960)). On a column of alumina (1 g) in chloride form, 2 mg of $H_2PO_4^-$ may be fixed from 50 ml of 0.5M K_2SO_4. (BBB)

25616 PRESENT TRENDS IN URANIUM REFINING TECHNIQUES. M. Vertès and M. Huet. Bull. Inform. Sci. Tech. (Paris), No. 80, 3-10(Feb. 1964). (In French)

The present status of uranium refining is briefly discussed from the economic and technical viewpoints. The most typical research and development presently underway is then reviewed in an attempt to discern future trends. The most common processes and those that most likely will replace them are compared from the economic standpoint. (D.C.W.)

25617 NEW PROCESS FOR THE TREATMENT OF URANOTHORIANITE. Ch. Lorrain. Bull. Inform. Sci. Tech. (Paris), No. 80, 57-67(Feb. 1964). (In French)

A more economical process is described for the preparation of thorium and uranyl nitrates of higher purity from solutions produced by the dissolution of uranothorianite ores from Madagascar in nitric acid. Its principle is the selective extraction in two successive stages of the thorium and uranium nitrates in tributylphosphate. The uranyl nitrate obtained is used directly in the preparation of nuclear-purity UO_3, while the thorium nitrate is concentrated by evaporation and crystallized. (auth)

25618 THE REFINING OF URANIUM AT THE MALVESI PLANT. M. Blanvillain. Bull. Inform. Sci. Tech. (Paris), No. 80, 69-85(Feb. 1964). (In French)

The different phases in the preparation of uranium from magnesium uranates are described, and the main improvements that have been made since the plant entered service are reviewed. (D.C.W.)

25619 SOME ANALYTIC PROBLEMS IN THE URANIUM REFINING INDUSTRY. J. Artaud. Bull. Inform. Sci. Tech. (Paris), No. 80, 135-8(Feb. 1964). (In French)

The main problems of analysis encountered during the refining of uranium are described. The problems associated with the uranium concentrates, finished products, calcium, and production control are considered as examples. (D.C.W.)

25620 ON THE PRECIPITATION OF RARE EARTH METALS FROM NON-AQUEOUS SOLUTIONS ON MERCURY CATHODES. Franz Matthes and Dietmar Flad. Freiberger Forschungsh., 6: B81: 109-13(1963). (In German)

An investigation was made on the electrolytic extraction of La using $NdCl_3$-C_2H_5OH electrolytes and liquid Hg as cathode. Current yield and electrolyte properties, such as electrical conductivity and viscosity, were measured. (Rev. Metal Lit. 121: No. 4, April 1961)

25621 EXTRACTION OF URANIUM(VI) FROM NITRIC ACID SOLUTIONS BY SOME CYCLOHEXYL- AND BENZYL-ALKYLAMINES. Taichi Sato (Government Chemical Industrial Research Inst., Tokyo). J. Appl. Chem. (London), 14: 176-80(Apr. 1964).

The partition of uranium(VI) between nitric acid solutions and benzene solutions of some cyclohexyl- and benzyl-alkylamines was investigated at different concentrations of nitric acid and solvent, and at different temperatures. An infrared spectral study was also made of the organic solutions obtained. The mechanism of U extraction in this system is discussed on the basis of the results obtained. (auth)

25622 SEPARATION OF EUROPIUM^{III} AND AMERICIUM^{III} BY SOLVENT EXTRACTION OF THEIR METAL CHELATE COMPLEXES. Tatsuya Sekine and David Dyrssen (Royal Inst. of Tech., Stockholm). Talanta, 11: 867-73(May 1964).

The separation of Eu^{3+} and Am^{3+} by solvent extraction was studied. The distribution of chelate complexes of these metal ions between 0.1M sodium perchlorate and chloroform or methylisobutylketone with nineteen chelating acids was determined. Amont these acids it was observed that some extract Eu^{3+} into the organic phase better than Am^{3+}, some extract Am^{3+} better, and some extract them equally well. The separation factor, $SF = D_{Eu}/D_{Am}$, was determined for twelve of these acids by the extraction of Eu^{3+} and Am^{3+} from 0.1M $(H,Na)ClO_4$. The values of log SF are as follows: dibutylphosphate (DBP), + 1.36; dioctylphosphate (DOP), +1.15; 1-phenyl-3-methyl-4-acetylpyrazolone-5, +0.54; 2-thenoyltrifluoracetone (TTA), + 0.48; neocupferron, +0.24; N-benzoylphenylhydroxylamine, +0.22; N-2,4-dichlorobenzoylphenylhydroxylamine, +0.12; β-isopropyltropolone (IPT), −0.01; 1-hydroxy-2-naphthoic acid, +0.03; 2-hydroxy-1-naphthoic acid, +0.01; 3-hydroxy-2-naphthoic acid, −0.02; and 5,7-dichloroxine, −0.99. From these results it follows that dialkylhydrogenphosphates and 5,7-dichloroxine are

the most suitable chelating acids for the separation of Eu^{3+} and Am^{3+} by solvent extraction. (auth)

25623 EXTRACTION OF URANIUM(VI) BY MONO-2,4-DIETHYLOCTYLORTHOPHOSPHORIC ACID. A. V. Gordievskii, V. A. Moskinov, and Fam Tsui Din. Zh. Neorgan. Khim., 9: 1002-6(Apr. 1964). (In Russian)

The extraction properties of mono-(2,4-diethyloctyl) orthophosphoric acid (MDPA) were examined and preparation of MDPA by the reaction of 2,4-diethyloctanol-1 with phosphoric anhydride was achieved by pouring alcohol into a phosphoric anhydride suspension in a diluent. The influence of the acid concentration on the distribution coefficient of U(VI) in extraction from sulfuric acid salt, and nitric acid solutions was analyzed. It was found that U(VI) extraction depends greatly on the concentration of acid in the aqueous phase. Extraction of U(VI) from phosphoric acid solutions is complicated by the presence of strong uranyl ion phosphate complexes. (R.V.J.)

25624 SOLVENT EXTRACTION STUDY OF THE SYSTEM MONAZITE RARE EARTH NITRATES–NITRIC ACID–WATER–TRIBUTYL PHOSPHATE. Brooks Martin Sharp. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 163p.

Using single stage equilibrium data for the systems shown below, plus the assumption of mutual immiscibility of water and tributyl phosphate (TBP), a calculation method was developed to give the stagewise conditions in a cascade of equilibrium stages with all species present in the flow streams: $La(NO_3)_3$–HNO_3–TBP–H_2O; $Pr(NO_3)_3$–HNO_3–TBP–H_2O; $Nd(NO_3)_3$–HNO_3–TBP–H_2O; $Sm(NO_3)_3$–HNO_3–TBP–H_2O; $La(NO_3)_3$–$Pr(NO_3)_3$–HNO_3–TBP–H_2O; $Nd(NO_3)_3$–$Pr(NO_3)_3$–HNO_3–TBP–H_2O; $Sm(NO_3)_3$–$Pr(NO_3)_3$–HNO_3–TBP–H_2O. The calculation method was checked via a series of simulated column experiments. The agreement between predicted and experimental stagewise conditions was considered reasonable, and the calculation is considered useful for engineering work. As the calculation is tedious and time consuming, digital computer programs were written for the IBM 7074 to calculate the stagewise conditions in cascades of interest. It is hoped these programs will be useful in design and optimization studies. (Dissertation Abstr.)

25625 IMPROVEMENTS IN OR RELATING TO THE EXTRACTION OF BERYLLIUM. Gervaise Luigi Milward, and John Charles Reeve (to United Kingdom Atomic Energy Authority). British Patent 960,457. June 10, 1964. Filed June 2, 1961.

A process is given for the solvent extraction of Be from aqueous acid solutions. The process uses an organic phase including a mixed aryl alykl phosphoric acid or a diaryl phosphoric acid. Suitable extractants are discussed, but the preferred extractant is methyl(para-tert-octylphenyl)-phosphoric acid. Several examples of the process are given in which the efficiency of such extractants is compared with that of di(2-ethylhexyl)phosphoric acid. (D.L.C.)

25626 IMPROVEMENTS IN OR RELATING TO CHEMICAL PROCESSING APPARATUS. Kenneth John Round (to United Kingdom Atomic Energy Authority). British Patent 960,652. June 10, 1964. Filed Dec. 7, 1961.

An apparatus is designed for the continuous recovery of Pu from nitric acid solutions by oxalate precipitation. In the apparatus, the Pu solution is treated with an oxalic acid solution in a stirred vessel and the resultant suspension is fed to a column in which the precipitate is first washed and then allowed to settle out so that it can be withdrawn from the base of the column. (D.L.C.)

25627 METHOD FOR THE SEPARATION OF THORIUM AND URANIUM AND THE PREPARATION OF THORIUM SULFATE OR THORIUM OXALATE. (to Kazimierz Josef Bril). German Patent 1,163,305. Feb. 20, 1964. Priority date Sept. 2, 1958, Brazil.

The method is carried out by the direct precipitation with a sulfate, bisulfate, or oxalate-containing watery solution at a temperature below 50°C from an organic solution of the nitrates. The precipitation is separated. (Gmelin Inst.)

25628 LIQUID-LIQUID CONTACTING APPARATUS. Maurice Charles Tanner and Leonard Lowes. U. S. Patent 3,134,650. May 26, 1964. Priority date Jan. 10, 1957, Great Britain.

An apparatus is designed for mixing the liquid phases in the mixer compartments of a mixer-settler, without the use of moving mechanical parts in contact with the liquids. The apparatus comprises a pair of mixer tubes dipping into each mixer compartment and means for increasing and decreasing the pressure in the mixer tubes. (D.L.C.)

25629 PROCESS AND APPARATUS FOR RECOVERY OF YELLOW CAKE DUST. William O. Bice (to Phillips Petroleum Co.). U. S. Patent 3,134,651. May 26, 1964. Filed Nov. 23, 1959.

Yellow cake dust is entrained in the flue gas used to dry the wet yellow cake in a uranium ore processing mill. The usual method for recovering the dust involves passing the off-gas from the drier through a liquid cyclone in admixture with water and then to a hydrofilter, whereby the dust is recovered as a slurry. In the method, a substantial loss of the dust still occurs in the off-gas from the hydrofilter, and the high concentration of dust in the slurry from the liquid cyclone leads to plugging in the lines. In order to eliminate these difficulties, the method is modified to include a treatment of the off-gas from the drier in a gas-solids cyclone separator before the liquid cyclone treatment. (D.L.C.)

25630 PLUTONIUM RECOVERY FROM NUCLEAR FUEL. Raymond H. Moore (to U. S. Atomic Energy Commission). U. S. Patent 3,136,599. June 9, 1964.

A process is given for plutonium recovery from metallic or oxidic nuclear fuel. Lithium chloride (or $CaCl_2$, $BaCl_2$, $SnCl_2$ or $MgCl_2$), alkali metal–aluminum double chloride, and aluminum metal are added and melted. The bulk of the plutonium is taken up by a distinct lithium-chloride phase, which is separated from the aluminum and the double-chloride phase. (AEC)

25631 SEPARATION OF ACTINIDES FROM EACH OTHER. Simeon A. Adar and Paul R. Fields (to U. S. Atomic Energy Commission). U. S. Patent 3,136,600. June 9, 1964.

A process is given for separating trivalent actinides from each other by ion exchange. The actinide-containing feed solution is made at least 7M in lithium nitrate prior to adsorption on an anion exchange resin. Fractional elution in the order of decreasing atomic numbers is accomplished with a 3–5M aqueous lithium nitrate solution. (AEC)

25632 PROCESS OF REMOVING RUTHENIUM FROM AQUEOUS SOLUTIONS. Lloyd L. Ames, Jr., Richard Fullerton, and Dennis W. Pearce (to U. S. Atomic Energy Commission). U. S. Patent 3,136,715. June 9, 1964.

A process is given for removing ruthenium from an aqueous solution of a pH value between 2 and 5. The process comprises adding ferrous ions thereto and contacting the solution with calcite whereby ferric oxide forms, deposits on the calcite, and sorbs the ruthenium. (AEC)

ENGINEERING

General

25633 (ERR-AN-336) LINEAR BENDING ANALYSIS OF A PRESSURIZED MULTICELL SHELL STRUCTURE. Paul E. Wilson, Sangiah Dharmarajan, and Philip W. Rogers (General Dynamics/Astronautics, San Diego, Calif.). Sept. 30, 1963. 34p. (GD/A-63-0968).

For very large launch and space vehicles, multicell shell structures were shown to possess certain advantages over those of conventional cylindrical shape. However, the structural design of vehicles incorporating multicell construction introduces a class of formidable stress analysis problems. An approximate analysis of the stresses and deflections in the webs and partial cylinders of a uniformly pressurized multicell container of monocoque construction is presented. Linear bending theory of circular cylindrical shells serves as the basic mathematical model. Nondimensional closed form solutions of the governing differential equations are presented. An extensive parametric study employing an IBM 7094 digital computer was carried out, and the overall structural behavior of many tank geometries was evaluated numerically. Typical numerical results are given. (auth)

25634 ENGINEERING DESIGN CONSIDERATIONS FOR A LIQUID–METAL IN-PILE LOOP. David Henry Thompson. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 86p.

Results are presented of an analytical investigation in the areas of fission-product activity, heat transfer, and materials for the preliminary planning of a high-temperature circulating-liquid-metal-fuel in-pile loop. Equations for the fission-product numbers and activities in a circulating fuel were derived from equations existing in the literature for the growth and decay of fission products resulting from one reactor operation and shutdown cycle. These equations were derived for continuous loop irradiation and for the more realistic loop irradiation in a reactor operating on a periodic cycle. The properties of several liquid-metal fuels were calculated and the fission-product activities in these fuels were determined for both the continuous and noncontinuous modes of reactor operation. Gamma heat effects on the in-core loop section geometry and the suitability of commercial high-temperature thermal insulation for in-pile loop application were investigated. Calculations pertaining to the out-of-pile portion of the loop were limited to the determination of thermal stress in the heat exchanger and the effect of coolant flow conditions on the required length of the heat exchanger. The saturated fission-product activity in the liquid-metal fuels would be approximately 2,940 curies per Kw of loop fission power and the corresponding activity at one year following two years of continuous fast-neutron irradiation would be approximately 53 curies per Kw of loop fission power. Contributions to the total fuel activity from the fuel components and fissionable nuclides produced by radiative capture are small except in dilute fuels. Gamma heating in the in-core pressure tube cannot be satisfactorily removed by conduction and radiation in a gas-filled annulus. The in-core loop section will require a cooling system separate from the circulating fuel that could also be used to provide loop heating during reactor shutdown periods and a means of detecting primary system failure. Because the liquid-metal heat exchanger can be built compactly, the size of the liquid-metal loop is dependent on the size of the pump and other necessary auxiliary components. (Dissertation Abstr.)

25635 PERFORMANCE ANALYSIS OF ELECTRICAL PROPULSION SYSTEMS WITH APPLICATION TO AN ARC ELECTRICAL–CHEMICAL HYBRID SYSTEM. Ahmed Nabil Hosny. Thesis, Austin, Tex., Univ. of Texas, 1963. 118p.

An electrical-chemical hybrid rocket system is proposed and analyzed. The performance analysis leads to the establishment of equations for computing the payloads that can be delivered in space by electrical rocket systems. The analysis of electrical rocket systems is conducted in Part 1. A method is devised for the selection of specific impulse and for finding the corresponding payload capacity, electrical energy consumption, and propellant consumption. This method is based on optimizing the performance to yield minimum cost of propellant plus electrical energy. The performance of an ordinary electrical propulsion (pure electrical) system is then derived from the hybrid system, based on the concept that a pure electrical system is a particular case of a hybrid electrical-chemical system with the chemical energy of reaction equal to zero. An electric arc-jet laboratory facility is described in Part 2. This facility has been constructed for determining experimentally the energy conversion efficiency from electrical energy to jet kinetic energy. The experimental work is described and the results are noted in Part 3. The results are plotted and are used in conjunction with the equations derived in Part 1 to compare the payload capacity of the hybrid electrical-chemical system as against that of the pure electrical system. It is found that the hybrid system shows merits over the pure electrical system. The merits are magnified particularly as the specific impulse decreases. (Dissertation Abstr.)

25636 HIGH VELOCITY ACCELERATOR FOR SMALL PROJECTILES. Wendell Jennison Caley, Jr. Thesis, Philadelphia, Temple Univ., 1963. 137p.

Using the stored energy of a charged capacitor, graphite has been exploded and the expansion of the resulting gas used to accelerate a stainless steel projectile (1 mm diameter) to 2 km/sec. It is estimated that the gas attained a temperature in the neighborhood of 8000 degrees K and a pressure of 6 or 7×10^4 atm. The electrical energy deposited in the carbon and the velocity of the projectiles were measured and used in the estimation of the temperature and pressure attained. Several parameters of the experiments were found to be different from optimum. With the incorporation of suggested modifications resulting from the investigations presented, velocities considerably greater than 2 km/sec should be attainable. It is suggested that further experimentation could be carried out with the aim of obtaining information about the vapor pressure curve of carbon at temperatures and pressures presently unattainable by static high pressure machines. The device is simple and inexpensive. The projectiles are accelerated singly and have a precisely predetermined trajectory. A velocity measuring device is described which is also inexpensive and yet provides for an accurate, stable an unambiguous determination of projectile velocities greater than 10 km/sec. (Dissertation Abstr.)

25637 IMPROVEMENTS IN AND RELATING TO FREQUENCY CONVERTORS. Leslie Carter Ludbrook and Lawrence Edward McAllister (to Associated Electrical Industries Ltd.). British Patent 948,130. Jan. 29, 1964. Filed Apr. 24, 1959.

A frequency convertor for producing a frequency below that of an a-c source, is designed for the lifting motors of control rods in a reactor. The convertor comprises a magnetic amplifier, means for cyclically applying d-c signals to control the amplitude of the amplifier pulses for stepping the pulses, a reversing switch in the load circuit, and means for operating the switch to produce with the stepped pulses opposing half cycles. Simultaneously different output waves can be produced, and the convertor is useful in cases where synchronous motors have to operate at low speed. (D.L.C.)

25638 IMPROVEMENTS IN OR RELATING TO RELEASABLE FLUID-TIGHT JOINTS. (to Siemens-Schuckwertwerke AG). British Patent 957,720. May 13, 1964. Priority date June 23, 1959, Germany.

A releasable fluid-tight joint is designed whose sealing is effected after its assembly by thermal expansion. The joint comprises cooperating first and second joint means with sealing and connecting portions, the joint means being designed so that its sealing is effected by relative thermal expansion of the joint means. Several embodiments of the joint are described. (D.L.C.)

Facilities and Equipment

Refer also to abstract 25600.

25639 (CISE-99) AUTOCLAVE CON CIRCOLAZIONE FORZATA. (Autoclave with Forced Circulation). F. Barbesino, E. Brutto, C. Gasparini, F. Mantega, and G. Perona (Centro Informazioni Studi Esperienze, Milan). Jan. 1964. 25p.

A forced-circulation autoclave for use in an ion exchange resin circuit is described. The water circulation and purification circuit functions as a pressure regulator by use of a hydraulic resistance across the flow. The circuit and its components and instrumentation are described in detail. Safety precautions are indicated, and results of preliminary operation are reported. (J.S.R.)

25640 (TID-20632) ON THE SPIRAL-GROOVED, SELF-ACTING, GAS BEARING. J. H. Vohr and C. H. T. Pan (Mechanical Technology Inc., Latham, N. Y.). Jan. 1964. Contracts [AT(30-1)-3237] and Nonr-3730(00). 46p. (MTI-63TR52)

A differential equation is derived for the "smoothed" overall pressure distribution around an arbitrarily shaped, grooved, journal bearing operating with a variable film thickness. The equation is based on the limiting case of an idealized bearing in which the number of grooves approaches infinity, but it is expected that the equation would apply quite well to a bearing with a large but finite number of grooves. An analytical solution is obtained for the pressure distribution around a spiral-grooved, cylindrical journal bearing valid for small eccentricities and incompressible lubricant. The analysis shows that appropriate grooving of journal bearings can result in a significant improvement in radial stiffness and a significant decrease in atittude angle for the bearing. These results indicate that grooving could be used to enhance the stability of journal bearings. (auth)

25641 HOT LABORATORY AND SPECIAL HANDLING EQUIPMENT. Atomics, 17: No. 3, 19-30(May-June 1964).

Consideration is given to the design of one of the most modern hot laboratories to be placed in service—that of the new hot laboratory for the Chemistry Division at Argonne National Laboratory—following which some special features of other installations will be reviewed. General hot laboratory practice, including ventilation, remote handling, magnetic manipulators, and special remote handling equipment are discussed. (P.C.H.)

25642 A FIELD-CONTROLLED UNIT WITH SCRs FOR THE POWER SUPPLY OF ELECTROMAGNETS. D. Lehm and J. Brunner (Siemens-Schuckertwerke AG, Erlangen, Ger.). Kerntechnik, 6: 141-5(Apr. 1964). (In German)

A method of power supply with high-quality field control was developed for electromagnets. This eliminated the disadvantages inherent in a current-controlled power supply due to the hysteresis of the magnet. A Hall generator for measuring the field and a specially developed circuit for the formation of the difference between reference and actual value provided high control accuracy. The use of silicon-controlled rectifiers as power correcting units gives the arrangement high dynamic control quality. The unit is relatively small and easily transportable. (auth)

25643 ECONOMIC ASSESSMENT OF VARIOUS EVAPORATOR TYPES. H. Mende (Pintsch Bamag AG, Butzbach, Ger.). Kerntechnik, 6: 159-63(Apr. 1964). (In German)

An evaporator heated by steam or hot vapors that are compressed by a steam injector was compared with an evaporator of the forced recirculation type with an electrically driven hot vapor compressor. The cost of utilities and the operating periods were found to highly affect the cost of the distillate produced. By adding the annual capital expenditure to the operating cost the price of the distillate increased to a very different extent for each of the three evaporator types. Although its capital cost is the highest the evaporator with forced recirculation was found to be the most economical in the long run. Diagrams show the influence of the variables on capital cost and operating cost. The optimum value of the overall cost of the evaporator installation can be determined only for each case by taking into account all operating conditions. (auth)

25644 POWER MANIPULATOR FOR "HOT CELLS." L. Seyfferth (Maschinenfabrik Augsburg-Nuremburg AG, Nuemburg). Kerntechnik, 6: 172(Apr. 1964). (In German)

Remotely controlled manipulators for use in hot cells are described. The manipulators have a lifting power of 340 kp. The design, control, and construction are discussed. (M.C.G.)

25645 OBSERVATIONS OF SHOCK WAVES IN AN ELECTRICALLY DRIVEN SHOCK TUBE. H. G. Ahlstrom (Univ. of Washington, Seattle), D. W. Mahaffey, L. Sanga, and R. I. Schoen. Phys. Fluids, 7: 906-7(June 1964).

Experiments with electromagnetic shock tubes to determine the conditions under which the shock wave and the arc heated driver gas separate are reported. (C.E.S.)

25646 A SCHEME FOR INCREASING THE EFFECTIVENESS OF SPACE-CHARGE NEUTRALIZATION IN ELECTRON-ION SYSTEMS. R. P. Wadhwa (Litton Industries, San Carlos, Calif.). Proc. IEEE (Inst. Elec. Electron. Engrs.), 52: 728-9(June 1964).

An arrangement for generating electrons for electron-ion neutralization in ion engines is described. An acceleration grid and two succeeding deceleration grids arranged in the transverse direction accelerate the ions and

then decelerate them in two steps. The first deceleration grid emits the electrons, the transverse motion of which is reduced by a periodic magnetic field also in the transverse direction. No electrons can reach the ion source. (D.C.W.)

25647 THE THEORY OF RECYCLE PROCESSES IN CHEMICAL ENGINEERING. M. F. Nagiev. A Pergamon Press Book. International Series of Monographs on Chemical Engineering. Translated by R. Hardbottle from "Ucheniye o Retsirkulyatsionnykh Protsessakh v Khimicheskoi Tekhnologii." New York, The Macmillan Company, 1964. 290p. $15.00.

Information is included on: elementary principles of the theory of recycle processes; theory of recycling processes with unrestricted composition of reactor charge; law and rules for the making-up of complex mixtures; general theory of recycle processes; experimental determination of the steady-state parameters of chemical processes; conversion of the terms in the basic recycling equations from weight to molar units; and development of elements for the technological process leading to high efficiencies per unit volume of reactor space. (P.C.H.)

25648 "ORNL" PUMP (Engineering Materials). (Oak Ridge National Lab., Tenn.). (CAPE-1077)

The small, inexpensive chemical pump operates at a high suction pressure and temperature; is totally enclosed; and has an output of 0 to 20 gpm at 40 ft of water head. The pump operates with a suction pressure from atmospheric to 1000 psi and circulates chemicals ranging in temperature to 250°C. Higher circulation fluid temperatures are possible if the pressure does not increase above 1000 psi and the temperature at the back of the pump stays below 100°C. All materials used in the pump that are subjected to the circulating fluid are selected for good corrosion resistance. All construction materials are of type 347 stainless steel, however, in the back of the pump bearings are constructed of Graphitar No. 14 and a rotor which has a chrome plated journal. The back of the pump is cooled to give the Graphitar and chrome plate the advantage of low temperatures in resisting chemical action. (20 drawings). (C.E.S.)

25649 IMPROVEMENTS IN OR RELATING TO HOSES FOR COOLING ARRANGEMENTS. Peter Weker (to Marconi Co.). British Patent 957,738. May 13, 1964. Filed June 15, 1961.

A hose is designed for cooling a remote object which is in a high-temperature zone at a considerable distance from the source of cooling medium, such as a television camera in a reactor. The hose comprises an inner hose member for supplying liquid coolant to the object to be cooled and having small spaced holes in its wall, and an outer hose member also having small spaced holes in its wall. In operation, some of the liquid coolant, e.g. CO_2, passes through the holes in the inner hose member to evaporate and fill the outer hose member with cooled gas which escapes at a low rate through the holes in the outer hose member. (D.L.C.)

25650 HIGH VOLTAGE GENERATOR. William Edward Bennett (to United Kingdom Atomic Energy Authority). British Patent 958,214. May 21, 1964. Filed July 29, 1959.

An electrical generator is designed for generating a d-c output at high potential and high wattage. The generator comprises a passage member of insulating material with a passage for gas flow, a corona discharge electrode in the passage, an electrode of lower potential than the discharge electrode, means for passing a gas through the electric field formed by the electrodes, and an ion collector downstream of the discharge electrode. (D.L.C.)

25651 IMPROVEMENTS IN NUCLEAR REACTOR FUEL ROD DESHEATHING MACHINES. Georges Bonnet (to Commissariat à l'Energie Atomique). British Patent 958,598. May 21, 1964. Priority date Sept. 19, 1920, France.

A machine is designed for continuously and automatically desheathing fuel elements in which the fuel rod has a slight radial play inside its sheath. The machine includes two rollers with parallel axis and shaped to provide conjointly a groove of a curvature midway between that of the sheath and that of the rod. In use, the fuel element is gripped inside the groove to produce a longitudinal fold in the sheath which is then cut, and the sheath is opened out and separated from the rod. (D.L.C.)

25652 IMPROVEMENTS IN OR RELATING TO LEAK VALVES. Eric Arthur Billett (to United Kingdom Atomic Energy Authority). British Patent 958,801. May 27, 1964. Filed Jan. 20, 1961.

A leak valve is designed for regulating extremely small gas flow rates (~0.01 μl/sec) to a mass spectrometer ion source. The valve comprises a base plate, a metal tube for the gas flow and having a thin-walled portion of fine bore, and a thrust member for controlled compression of the reduced bore portion to vary the cross-sectional area available for gas flow. (D.L.C.)

25653 MAGNETICALLY CONTROLLED FLUID-TIGHT CONVEYING APPARATUS. Jean Blin and Andre Valentin (to Commissariat à l'Energie Atomique). British Patent 958,974. May 27, 1964. Priority date Nov. 6, 1959, France.

A magnetically controlled handling apparatus is designed for transferring material or equipment between different points in an isolated medium, such as in cells containing radioactive materials. The apparatus comprises a fluid-tight tunnel made of a non-magnetic material and having a flat or slightly curved wall, at least one bucket in the tunnel fitted with running rollers, and a driving member outside the tunnel for controlling the movement of the bucket. Magnets are fitted to the bucket and driving member. (D.L.C.)

25654 IMPROVEMENTS IN OR RELATING TO ELECTRICAL CIRCUITS FOR SELECTING AND CONTROLLING STEPPING MOTORS. Leonardo Caldarola and John Robert Dean (to United Kingdom Atomic Energy Authority). British Patent 960,079. June 10, 1964. Filed Jan. 26, 1962.

A control circuit is designed for selectively operating any one of a number of stepping motors such as in drive mechanisms for reactor control rods. The control circuit comprises a drive circuit for applying d-c to pole pairs of a selected motor, selection means for applying the drive circuit output to any one of the motors, a stop circuit including a relay for stopping the motor on a given phase, and switching means for transferring the phase to an earth circuit before connecting a new motor to the drive circuit. The drive circuit is adapted to receive pulses from a pulse generator with means for selecting a predetermined degree of motor travel. (D.L.C.)

25655 GAS DISCHARGE ION SOURCE. E. M. Reykhrudel, G. V. Smirnitskaya, and T. I. Ivanova. USSR Patent 159,900.

A gas discharge ion source containing a hollow anode and two cold cathodes is described. For increasing the current density in the ion beam and raising the efficiency of the source, the anode is made in the form of a honey-

comb structure; one of the cathodes is in the form of a flat grid, and the focusing electrode is a grid in the form of a spherical segment. (AID Press Vol. 2: No. 226, May 1964)

Heat Transfer and Fluid Flow

Refer also to abstracts 26152 and 26824.

25656 (NYO-2930-2) A STUDY OF THE EFFECT OF THE PRESENCE OF SUSPENDED SOLIDS ON LAGRANGIAN PROPERTIES OF FLUID TURBULENCE. Technical Report No. 102-ME-F. Richard L. Peskin and Chun-Hsun Rin (Rutgers Univ., New Brunswick, N. J. Coll. of Engineering). Mar. 1964. Contract AT(30-1)-2930. 84p.

A helium tracer-diffusion study of Lagrangian gas turbulence was carried out in a flowing gas-solid suspension. The effect of small suspended particles on the eddy diffusivity and Lagrangian correlation was determined. It was found that the prime effects of the solids motion were a decrease in eddy diffusivity, a shift to higher wave number of the spectrum, and a narrowing of the correlation curve. The solids motion essentially increased the randomness of fluid motion. (auth)

25657 (NYO-3114-1) QUARTERLY PROGRESS REPORT [ON TWO-PHASE FLOW], JANUARY–MARCH 1964. G. B. Wallis, D. A. Steen, and J. M. Turner (Dartmouth Coll., Hanover, N. H. Thayer School of Engineering). Work Performed under United States–Euratom Joint Research and Development Program. Contract AT (30-1)-3114. 26p. (EURAEC-1070)

Studies of void fraction in annular flow and the onset of droplet entrainment are reported. Experiments have been performed in order to improve the void fraction theory. The onset of entrainment has been measured with fluids for which the viscosity and surface tension varied considerably. Both these parameters and the gas density were found to have an influence on liquid entrainment. (auth)

25658 LATERAL SOLIDS MIXING IN FLUIDIZED-PACKED BEDS. John D. Gabor (Argonne National Lab., Ill.). A.I.Ch.E. (Am. Inst. Chem. Engrs.) J., 10: 345-50(May 1964).

A study was made of the mixing of particulate solids fluidized in the voids of a packed bed of larger nonfluidized bodies. In such a system heat transfer rates are dependent on the movement of fluidized particles. A measure of the particle movement was achieved by the determination of diffusion coefficients for the rates of solids mixing in the lateral direction when metal shot is fluidized in the voids of spherical and cylindrical packing. Experimental data showed that the particle mixing was related to the void structure of the packed bed by a random walk model. A general correlation was made for fluidized-solids diffusivity in spherically packed beds. (P.C.H.)

25659 MEASUREMENT AND CORRELATION OF TURBULENT FRICTION FACTORS OF THORIA SUSPENSIONS AT ELEVATED TEMPERATURES. D. M. Eissenberg (Oak Ridge National Lab., Tenn.). A.I.Ch.E. (Am. Inst. Chem. Engrs.) J., 10: 403-7(May 1964).

Turbulent friction factors of non-Newtonian flocculate thoria suspensions were measured at elevated temperatures and correlated with a Reynolds number based on the measured Newtonian friction factor vs. Reynolds number relation. A decrease in friction factor at high concentrations of thoria was ascribed to a change in the velocity profile. (auth)

25660 REDUCING EXHAUST STEAM WETNESS IN MAGNOX REACTOR SYSTEMS. N. G. Worley (Babcock and Wilcox Ltd., London). Eng. Boiler House Rev., 84-90 (Mar. 1964).

The capabilities and merits of water separators, steam-steam reheaters, and separately fired superheaters for reducing turbine exhaust wetness are discussed. Performance calculations, comparisons, possible arrangements, and the effects on plant efficiency are covered. (D.C.W.)

25661 HEAT TRANSFER BY LIQUID METALS. DESCRIPTION OF A TEST INSTALLATION. M. Brachet (Centre de Recherches et d'Essais, Chatou, France). Ind. Chim. Belge, 29: 23-34(Jan. 1964). (In French)

The utilization of liquid metals and, particularly, sodium for reactor cooling poses numerous problems and necessitates various tests. A detailed description is given of a liquid sodium installation utilized by the Centre de Recherches et d'Essais in Chatou. With this equipment a study of heat transfer by liquid sodium was started. An experimental device is described, and the first results obtained are reported and compared with those obtained by others. (tr-auth)

25662 EXPANSION OF A VERY LOW QUALITY TWO-PHASE FLUID THROUGH A CONVERGENT-DIVERGENT NOZZLE. E. S. Starkman (Univ. of California, Berkeley), V. E. Schrock, K. F. Neusen, and D. J. Maneely. J. Basic Eng., 86: 247-56(June 1964).

Flow in de Laval nozzles of high pressure, low-quality steam-water mixtures was investigated to determine the resulting mass flow rates and to acquire design criteria information. Qualities ranged from 0 to 20 percent and pressures up to 1000 psia. Comparisons of the experimental data to three simple models—(a) isentropic expansion, (b) frozen composition, and (c) slip flow—showed satisfactory correspondence at all conditions except for qualities very close to saturated liquid. Observation was made that a condition similar to shock resulted when the nozzles were overexpanded. (auth)

25663 VOID FRACTION MEASUREMENTS IN A CAVITATING VENTURI. Willy Smith, G. L. Atkinson, and F. G. Hammitt (Univ. of Michigan, Ann Arbor). J. Basic Eng., 86: 265-74(June 1964).

A method is described for obtaining precise measurements of local density (or void fraction) in an axially symmetrical cavitating flow regime wherein a heavy fluid such as mercury, molten lead, and so on, is used. The method can be adapted to light fluids by substituting a softer radiation source. Significant information regarding the cavitating flow regime in a particular venturi operating with mercury was obtained. It was shown that regions where substantial damage to test specimens was previously noted have void fractions of the order of only five percent. (auth)

25664 TRANSIENT HEAT TRANSFER IN A VAPOR-HEATED HEAT EXCHANGER WITH ARBITRARY TIMEWISE-VARIANT FLOW PERTURBATION. Wen-jei Yang (Univ. of Michigan, Ann Arbor). J. Heat Transfer, 86: 133-42(May 1964).

An analysis was made of transient heat transfer in a vapor-heated heat exchanger with an arbitrary timewise-variant flow perturbation. The heat-transfer coefficient between the tube and coolant was assumed to vary like the n power of the coolant velocity. Results were obtained through the use of the perturbation technique. General relations are presented in closed form and their application is illustrated by carrying out some typical examples: step, linear, exponential, and sinusoidal transients in the coolant

flow velocity. The influence of the system parameters on the variation of the coolant temperature was investigated. A phenomenon of resonance in the amplitude-ratio and phase-shift was disclosed for the oscillating flow transient. This phenomenon is explained by analyzing the enthalpy change of the coolant particle in the heat exchanger. The results were also compared with the analyses that have assumed a constant heat-transfer coefficient. Heat exchangers to which the results apply include the double-pipe and shell- and tube-type heat exchangers. (auth)

25665 TWO-PHASE PRESSURE DROP ACROSS VERTICALLY MOUNTED THICK PLATE RESTRICTIONS. J. O. Cermak, J. J. Jicha, and R. G. Lighter (Martin Marietta Corp., Baltimore). J. Heat Transfer, 86: 227-39(May 1964).

Studies were made to obtain two-phase (water–steam) flow pressure drop for thick-plate flow restrictions. Two-phase pressure drop data for uniformly heated tubular test sections were also obtained. A statistically designed program encompassing 536 runs was conducted employing 30-in. long test sections of six geometries. Two nozzle type, three thick-plate orifice type, and one straight expansion type flow restrictions were investigated. The ranges of parameters were investigated at 0 to 23% quality, 500 to 1500 lb/hr flow rate, 800 to 1600 psia pressure, and 0.416, 0.500 in. tube diameters. A complete factorial experimental design was employed that enabled an analysis of variance to be conducted to determine the significance of the flow rate, quality, and pressure on the response of the static pressure drop. Each of these factors was found to be highly significant. Inherent in the statistical methods employed was the establishment of the 95% confidence limits on the data for each test section studied. These limits ranged from 0.009 to 0.306 psi for the largest and smallest restriction diameters, respectively. The precision of the data was well within the limits for experimental two-phase flow technology. The results of an error analysis indicate that the accuracy with which flow rate, pressure, and geometry were determined gave rise to insignificant errors and the resulting maximum possible error in quality was less than the lower limit of the correlation equation confidence limits. The results were compared with only moderate success to theoretical models by others. Several attempts at correlating the data resulted in a design equation to calculate the static pressure drop for the flow restrictions investigated. (P.C.H.)

25666 TRANSIENT FORCED CONVECTION FROM A FLAT PLATE SUBJECTED TO A STEP ENERGY INPUT. D. E. Adams (Cornell Aeronautical Lab., Inc., Buffalo, N. Y.) and B. Gebhart. J. Heat Transfer, 86: 253-8(May 1964).

Transient forced convection from a flat plate subjected to a step energy input to the plate was considered for established laminar boundary-layer flow. Cases considered were a plate of zero heat capacity and a plate of relatively high heat capacity. The zero heat capacity case was solved by an integral method with different velocity profile approximations. A quasistatic solution, based on the plate energy balance, is given for the high heat capacity case. Experimental measurements verified the high heat capacity analysis. (auth)

25667 SLIP INSTABILITY. Anthony A. Amsden and Francis H. Harlow (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids, 7: 327-34(Mar. 1964). (LADC-5843)

The effects of viscosity and large disturbance amplitude on the instability occurring at a slip interface between two parts of an incompressible fluid are discussed. In particular it is shown how an analysis by Carrier can be applied to explain the train of small vortices generated at a shearing edge, and comparisons with experimental results are given for a number of examples. In addition, the numerical method of Fromm was applied to obtain complete solutions of the slip instability problem, and numerous results are presented to show additional comparisons with the linearized theory for viscous fluids, and to show in detail the structure of the late-stage nonlinear flow in which the vortex sheet may tend to roll up. (auth)

25668 FLOW DEVELOPMENT IN THE HYDRODYNAMIC ENTRANCE REGION OF THE TUBES AND DUCTS. E. M. Sparrow, S. H. Lin, and T. S. Lundgren (Univ. of Minnesota, Minneapolis). Phys. Fluids, 7: 338-47(Mar. 1964).

A new method of analysis was devised for determining the developing laminar flow and corresponding pressure drop in the entrance region of tubes and ducts. The method is formulated in a general manner that applies to ducts of any cross section. Specific application is made for flow in a circular tube and in a parallel-plate channel, and the velocity distribution and pressure-drop results are compared with experimental data and prior analyses. These comparisons lend strong support to the findings of the present analysis. (auth)

25669 SPIRAL FLOW IN A STATIONARY POROUS PIPE. Stephen Prager (Univ. of Minnesota, Minneapolis). Phys. Fluids, 7: 907-8(June 1964). (TID-19965)

Steady incompressible flow in an infinitely long porous pipe with uniform suction at the walls in which there exists a gap for suction Reynolds numbers between 2.4 and 9.0 where apparently no solutions to the Navier-Stokes equation can be found is considered. It is shown that steady-state solutions can be found within the gap region if the angular velocity is not required to vanish. (C.E.S.)

25670 SOME SURFACE PARAMETERS INFLUENCING THE THERMAL EXCHANGES IN BOILING. S. Faggiani. Thermotechnica (Milan), 17: 734-8(1963). (In Italian)

After a brief review of the research done previously to establish the effect of the surface state on the phenomenon of thermal exchange in boiling, the different results, obtained by modifying the surface state of the exchanger either mechanically or chemically, are compared. The limits of agreements between experimental data and the theory usually proposed to interpret the phenomena are discussed critically. (tr-auth)

25671 EXPERIMENTS ON THE MECHANISM OF SATURATED NUCLEATE POOL BOILING HEAT TRANSFER. Bruce David Marcus. Thesis, Ithaca, N. Y., Cornell Univ., 1963. 214p.

The mechanism of saturated nucleate pool boiling, at heat fluxes below the "first hydrodynamic transition" (vapor leaves the surface as intermittent bubbles), has been studied experimentally. Four series of experiments, concerning different aspects of the problem, are described and the results presented. Two of the experiments dealt with localized heat transfer and nucleation phenomena for a particular active site. An apparatus was used which permitted boiling distilled water from a single nucleation site on a resistance wire. Measurements were made of the active site's nucleation frequency. A relation of the form $\bar{f} = Cq''^{a}$ was found to exist between the average nucleation frequency ($\bar{f}$) and the heat flux (q''). (The nucleation frequency was not a constant, even for an isolated active site.)

Measurements were also made which synchronized the surface temperature cycle near the active site to photographs of the nucleation cycle. It was observed that surface cooling began as the bubble began to grow and continued for a short while after the bubble departed. The results indicate that vaporization of a liquid micro-layer between the growing bubble and the heating surface, as well as surface quenching by the cool bulk liquid which replaces the departing bubble are significant mechanisms in the localized surface heat transfer process at an active site. Quantitative measurements also indicated that the growing bubble received most of its energy from its superheated environment rather than from the heating surface. The other two experiments dealt with the integrated heat transfer process for the entire surface. This involved heat transfer by natural convection and forced convection (due to boundary layer turbulence set up by the growing and departing vapor bubbles) as well as the mechanisms mentioned previously. In the first of these experiments, distilled water was boiled from a flat heating surface immersed in the water. The surface could be inclined to any angle between the horizontal and vertical. Experiments were performed at constant heat flux and the coefficient of heat transfer (h) measured as a function of the surface angle. The results for nucleate boiling indicated that the coefficient of heat transfer increases with increasing surface angle (as measured from the horizontal). On the other hand, for saturated natural convection the trend was reversed and the horizontal surface exhibited the highest heat transfer coefficient. It was concluded from these experiments that, in the range of heat flux studied (5,000 to 35,500 Btu/hr-ft^2), the action of the departing vapor bubbles in disturbing the superheated boundary layer adjacent to the heating surface was a significant factor in establishing the heat transfer coefficient. The last experiment concerned the measurement of the temperature profiles within the superheated thermal boundary layer adjacent to the heating surface. A microthermocouple probe was used to traverse the boundary layer. The measurements were made for a horizontal surface at heat fluxes of 1,000 to 40,000 Btu/hr-ft^2. The temperature at a point in the boundary layer was found to be a rapidly and widely fluctuating variable which indicated a substantial level of turbulence. The amplitude of these fluctuations reached a maximum at a point slightly above the surface and decreased linearly to a very small value at the surface. The average, maximum, and minimum temperature profiles were all observed to become linear very near the heating surface. For low heat fluxes, the average temperature gradient in this linear region could be predicted by: $dT/dy = -1.616\ q''$ where q'' is expressed in Btu/hr-ft^2 and dT/dy in °F/ft. The measured temperature profiles also yielded values for the thickness of the superheated thermal boundary layer (δ). δ was found to vary with the heat transfer coefficient as: $\delta = Ch^b$. For values of h less than 700 Btu/hr-ft^2-°F the exponent b was −1.0, while for h > 700 Btu/hr-ft^2-°F it was −0.5. (Dissertation Abstr.)

25672 IMPROVEMENTS IN OR RELATING TO MULTITUBULAR HEAT EXCHANGER. Pierre Legrand. British Patent 957,730. May 13, 1964. Priority date Oct. 14, 1959, France.

A multitubular heat exchanger in which groups of tubes operate cyclically, is designed in which the tubes are very resilient and hence can expand or contract freely. The tubes are bent in a zigzag manner and are parallel to the flat walls of the casing, adjacent tubes nesting within each other. The ends of the casing are flared to provide inlet and outlet headers for the fluid flowing over the tubes. (D.L.C.)

25673 IMPROVEMENTS IN OR RELATING TO VOLUTELESS CENTRIFUGAL PUMPS. David Girdler Cross and Robert Marshall Menzies (to United Kingdom Atomic Energy Authority). British Patent 958,840. May 27, 1964. Filed June 6, 1961.

A voluteless pump is described for lifting liquids in a mixer-settler apparatus being used in the processing of radioactive materials. The pump has an impeller comprising a first circular plate with a central aperture, a second circular plate connected to the first plate by a plurality of blades which are arranged to draw liquid through the central aperture on rotation of the impeller, and an operating stem, the impeller being suspended in a cylindrical casing. Some typical pump dimensions are given. (D.L.C.)

Materials Testing

25674 (ANL-6728) A PULSED ELECTROMAGNETIC TEST SYSTEM APPLIED TO THE INSPECTION OF THIN-WALLED TUBING. C. J. Renken (Argonne National Lab., Ill.). Mar. 1964. Contract W-31-109-eng-38. 16p.

The pulsed electromagnetic test systems discussed seem to compare favorably with the commercial sinusoidal test equipment that is intended for parallel applications, and do offer some interesting advantages as a result of pulsed operation, notably stability and resolution. It is also most likely that further improvement in system performance will be realized as operating experience is acquired on a variety of test problems. (auth)

25675 (ANL-6868(p.219-28)) DEVELOPMENT OF NONDESTRUCTIVE TESTING METHODS. (Argonne National Lab., Ill.).

Nondestructive testing techniques and equipment are investigated for use in the evaluation of reactor materials. Information is included on ultrasonic imaging, neutron imaging, infrared radiation, eddy-current tests, and radiography. (N.W.R.)

25676 DETECTION OF FLAWS BY GAMMA SPECTROMETRY. Claude Broquet and Jean Cabaret. Bull. Inform. A.T.E.N. (Assoc. Tech. Energie Nucl.), No. 46, Suppl. No. 4, 4-7(Apr. 15, 1964). (In French)

A new method for the discovery of flaws in very thick mechanical samples is presented. The method uses radiation scattered by the flaws as well as that directly transmitted. Very sensitive measurements are permitted, as the scintillation detectors used have a high response for low-energy scattered radiation. Samples between about 0.6 and 30 half value layers can be controlled. This method can also be used in control of concrete density and compactness. (M.J.T.)

25677 EXPERIENCES WITH A TRANSPORTABLE 18 Mev BETATRON FOR NONDESTRUCTIVE TESTING. R. Schittenhelm and H. J. Bohn (Siemens-Reiniger-Werke, Erlangen, Ger.). Mater. Evaluation, 22: 263-5(June 1964).

Some technical details of the device are presented; and its efficiency for x-raying steel is discussed, using experimental results. Exposure time and minute detail are considered, as well as steel thickness. Steel thicknesses of up to 16 to 20 in. can be x rayed in economical exposure times. The dose rate around the beam is only about 50 mr/hr at a distance of 5 m. Materials other than steel can also be x rayed. (D.C.W.)

25678 THE NON-DESTRUCTIVE TESTING OF REACTOR COMPONENTS BY EDDY-CURRENT METHODS. F. Foerster. Metall, 18: 450-60(May 1964). (In German)

Electromagnetic and magnetic methods of testing reactor components are discussed. Equipment, procedures, and examples of results are described. (M.C.G.)

25679 VIBRATION METHOD FOR THE ELASTIC CONSTANTS OF SMALL PLATES. Charles D. Bopp (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr., 35: 703-7 (June 1964).

A method is described in which a clamped mode of vibration is used in order that the driving force may exceed the weight of the specimen. A supported cantilever plate is vibrated in flexural and torsional modes by driving the support. An approximate solution of the vibration equation is used to calculate the elastic constants from the resonant frequencies. The solution is expressed in terms of the ratio of the resonant frequency of the unknown specimen to that of a standard of the same length and width, to reduce the precision required in specification of the support location. This method was applied in a radiation effects study to measure the Young's moduli of small ceramic plates within 3–5%. The accuracy was limited in this instance by the dimensional tolerances of the specimens. (auth)

Protective Structures

25680 (TID-20648) STUDIES OF THE FATIGUE STRENGTH OF PRESSURE VESSELS. 1. CYCLIC PRESSURE TESTS OF LARGE SIZE PRESSURE VESSELS. 2. LOW CYCLE FATIGUE TESTING OF ONE-HALF SCALE MODELS PRESSURE VESSELS. 3. EFFECT OF WELD DEFECTS ON THE FATIGUE STRENGTH OF A302 B STEEL. Progress Report No. 8. A. G. Pickett, W. R. Schmidt, and S. C. Grigory (Southwest Research Inst., San Antonio). May 13, 1964. Contract AT(11-1)-1228. 39p.

Results of cyclic pressure tests on the plastic fatigue strength of large pressure vessels, tests of size effects on the fatigue strength of large pressure vessels, and weld defect fatigue tests on steel for pressure vessels are presented. (M.C.G.)

25681 IMPROVEMENTS IN FALL-OUT SHELTERS. Robert Fisher (to The Atomic Shelter Co. Ltd.). British Patent 960,078. June 10, 1964. Filed Dec. 23, 1961.

A fallout shelter is designed for protection against radioactive fallout for nuclear explosions. The shelter is constructed with double walls, the cavity between which is filled in with sand or gravel traversed by ties, and a lead-lined door and a concrete roof covered by 2–3 ft sand or gravel are provided. Overlapping baffle walls are arranged transversely in a passage from the door to give access to the shelter. (D.L.C.)

Vacuum Engineering

25682 ORGANIZATION AND METHODS USED FOR VACUUM TIGHTNESS AT THE PIERRELATTE ISOTOPE SEPARATION PLANT. G. Mongodin, J. Delafosse, H. Deterck, C. Guilbard, and Y. Benet. Vide, 18: 528-9(Nov.-Dec. 1963). (In French)

The leakproof properties in a gaseous diffusion plant for the separation of ^{235}U involves numerous problems of vacuum techniques. The nature and scope of these problems and the tightness control equipment designed for the Pierrelatte complex are described. The efficiency of the quality control in the manufacture of the equipment is also considered. The use of the helium method for leak detection is discussed. The factors affecting the sensitivity of the method and those affecting the maximum rate of inspection of the components to be tested are examined. (tr-auth)

25683 ULTRAHOCHVAKUUM. EINE EINFUHRUNG. (Ultra-high Vacuum. An Introduction). E. A. Trendelenburg. Karlsruhe, Ger., Verlag G. Braun, 1963. 201p. DM 42.

The concept of ultrahigh vacuum and the uses of ultrahigh vacuum technology are discussed. Principles of high-vacuum physics are outlined. Examples are given of how ultrahigh vacuum technology made possible several physical experiments, which could not be carried out under normal vacuum conditions. Peculiarities of ultrahigh vacuum physics are discussed, including materials problems (permeation, desorption, and adsorption). Special measuring methods and problems in an ultrahigh vacuum are described. Oil-diffusion, mercury-diffusion, molecular, and surface pumps are discussed and evaluated. Materials, permanent connections, flange connections, valves, rotation methods, viewing glass, electric current conductivity, equipment construction, operation of an ultrahigh vacuum system, and methods of searching for leaks are described. (M.C.G.)

GEOLOGY AND MINERALOGY

General

25684 (TEI-839) TRITIUM USED AS A GROUND-WATER TRACER BETWEEN LAKE McMILLAN AND MAJOR JOHNSON SPRINGS, EDDY COUNTY, NEW MEXICO. H. O. Reeder, With a Section on LABORATORY ASPECTS OF TRACER SELECTION AND TRITIUM DETECTION. L. L. Thatcher (Geological Survey, Washington, D. C.). June 1963. 135p.

A large amount of water leaks through the floor of Lake McMillan to underground solution channels or openings in the gypsiferous Seven Rivers Formation. After background information on the natural and fallout tritium content of water in the Lake McMillan area was obtained, 150 curies of tritium were injected into the 17,400 acre-feet of water in Lake McMillan on April 24 and 25, 1961. The concentration of tritium in the lake was raised from about 40 or 50 T.U. (tritium units) to about 2,200 T.U. (7.13×10^{-6} μc/ml). An attempt was made to follow this water through the underground reservoir to discharge areas at Major Johnson Springs about 3½ miles downstream. Methods were developed to load the tritium into the mixing and dosing tank, and to disperse the tritiated water in the lake. A mixing tank was designed and built specially for the project. A catamaran-type boat was used to transport the tank of tritiated water over the lake, because of the boat's stability and load-carrying capacity. The tritium concentration in Lake McMillan dropped after injection to 107 T.U. by July 25, primarily due to exchange of water by inflow and outflow from the lake. The tritiated water that leaked into the Seven Rivers Formation from Lake McMillan was traced as it passed underground through that formation to the springs. The relatively small amount of lake water entering the groundwater reservoir during the time of high-tritium content of the lake caused lower than desirable tritium peaks at the sampling sites downstream. Peaks in tritium concentrations in water at sites downstream from Lake McMillan indicated that the travel time of the tritiated water from Lake McMillan to the Major Johnson Springs area is about 2.75 to 3 months, which is comparable to the travel time of 2 to 3 months determined in an earlier study by Theis and others utilizing variations in the natural chloride content of the water as the tracer. This represents a probable minimum travel time for a significant quantity of water to pass from the lake to the springs. (auth)

25685 THE FIRST DETERMINATIONS OF ABSOLUTE AGE IN LOESS SOILS OF THE RUSSIAN STEPPE. A. A. Velichko, A. L. Devirts, E. I. Dobkina, T. D. Morozova, and O. A. Chichagova (Geography Inst. of Academy of Sciences, USSR and Vernadskii Inst., of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 155: 555-8(Mar. 21, 1964). (In Russian)

A loess sample was taken in the region of Bryansk, and another sample of the same strata was taken 250 km to the south. The soil contained only 0.7 to 0.8% carbon, and an initial sample of 10 to 15 kg of soil was required for the ^{14}C analysis. The carbon fraction was burned to CO_2 in a current of oxygen, and the ^{14}C was counted on a proportional counter having a volume of 1 liter at a pressure of 2 atm. The age of the samples was found to be 24,920 ± 1800 years and 24,200 ± 1680 years. These results confirm the stratigraphic importance of the Bryansk stratum. (TTT)

25686 NOTES CONCERNING THE GEOCHEMISTRY OF PHOSPHORUS, FLUORINE, URANIUM, AND RADIUM IN SOME MARINE ROCKS IN ISRAEL. E. Mazor (Israel Atomic Energy Commission, Tel-Aviv). Israel J. Earth-Sci., 12: 41-52(July 1963).

Phosphorus, F, U, Ra, Th, and K were analyzed in 38 samples of marine sediments ranging in age from Santonian to Eocene and including phosphorite, diagenetically changed phosphoritic rocks, limestone, chalk, and marl. The abundances of the first four mentioned elements were found to be in constant ratios, although the P_2O_5 content varied from less than 1 up to 33%. There seems to be essentially one kind of phosphate mineral in all the samples, its F to P ratio being that of a carbonate-fluorapatite. The radioactive equilibrium of the U and Ra indicates that the apatite has not been disturbed by weathering processes for at least the last 10,000 years. All the above geochemical relation agree well with data published on phosphorites in other parts of the world. The carbonate-fluorapatite in the samples of the Senonian Mottled zone formation and in the ferruginous phosphorites, accompanying the Companian–Eocene unconformity in the Ramon area, was not affected by diagenetic processes. (auth)

Natural Radioactivity and Fallout

Refer also to abstracts 25055 and 25727.

25687 (NP-13981) THE BODY BURDEN OF ^{137}Cs IN PEOPLE OF SOUTHERN FINLAND 1961–1963. Erkki Haesaenen and Jorma K. Miettinen (Helsinki. Univ.). 13p.

The body burden of ^{137}Cs in people residing in southern Finland was determined from 1961 to 1963 by whole-body counting. The ^{137}Cs content of all main food items and the total diet was also determined. The ^{137}Cs content of milk in Helsinki was relatively constant until July 1963, when it increased about 60% in one week. The ^{137}Cs content in beef also showed a marked increase during the same period. The body burden of ^{137}Cs increased by 65% in women and 89% in men from Feb. to Dec. 1963. The K contents remained unchanged in both groups. Comparison of the data with measurements of ^{137}Cs content in man and diet of Finnish Lapps and residents of England and Germany indicates that ^{137}Cs has a shorter biological half time in people of northern countries than elsewhere. (C.H.)

25688 (TID-20638) ADSORPTION EQUILIBRIA BETWEEN EARTH MATERIALS AND RADIONUCLIDES, CAPE THOMPSON, ALASKA. J. H. Baker, W. A. Beetem, and J. S. Wahlberg (Geological Survey, Washington, D. C.). Mar. 1964. 40p.

The concept and the derivation of a distribution coefficient were developed. Ion exchange and the nature of competition among cations are given. Distribution coefficients for carrier-free cesium, strontium, and iodine were determined on 17 samples of earth materials collected during July, 1961, in the vicinity of Cape Thompson, northwestern Alaska. High percentage uptake of these ions was measured under the test conditions. Cesium adsorption, at 1 day, was found to be represented by the mass-action equa-

tion. The distribution coefficients for cesium adsorption were so large that, in all but a few cases, very little of this nuclide would remain long in solution in the natural waters of the area. Strontium adsorption was found to be a function of the calcium-plus-magnesium concentration and to be independent of the sodium concentration. In most samples, its equilibrium was reached in less than 1 day. Iodine sorption varied with percent organic matter in the samples. If the iodine remained in contact with organic matter for several days, a substantial part of it probably would be removed from solution in the natural waters. (auth)

25689 STUDY OF ENVIRONMENTAL RADIOACTIVITY IN VENEZUELA (1960-1962). J. Solanas, A. Darder, and P. Bertou (Instituto Venezolano de Investigaciones Cientificas, Caracas). Acta Cient. Venezolana, 14: 156-60(Dec. 1963). (In Spanish)

Since January 1960 the Venezuelan Institute for Scientific Research has measured atmospheric radioactivity by means of a stationary station situated 14 km from Caracas at an altitude of 2000 m, and a mobile unit which makes assays throughout the country. Both units were also used to determine the amount of ^{90}Sr in rain water. The average amount of atmospheric β activity/month varied from 0.00 to 5.731 $\mu\mu C/m^3$ air; the yearly averages were: 1960, 0.112; 1961, 0.067; and 1962, 0.927 $\mu\mu C/m^3$. The average monthly level of ^{90}Sr deposition on the earth's surface by rain was 0.00 to 1.00 mC/mi^2 and the yearly averages were: 1960, 0.270; 1961, 0.147; and 1962, 0.490 mC/mi^2. A linear relation appeared to exist between cumulative ^{90}Sr deposition and cumulative rainfall. In 70% of measurements made during 1960 through 1962 the values for ^{90}Sr increased at the same rate as the increase in rainfall. Correlation between activity in the air and precipitation shows a complex inverse relation. It was found that atmospheric contamination decreased with an increase in rainfall presumably due to the precipitation by rain of atmospheric dust particles. Following a heavy rain the air was relatively free of radioactive particles for a period of time dependent on diverse meteorologic factors. Compared with other nations of the American continents, Venezuela has a medium level of atmospheric contamination and ^{90}Sr deposition. Finally, it was pointed out that Venezuela is affected more rapidly and to a greater degree by French nuclear explosions in the Sahara Desert, due, among other factors, to their taking place in the equatorial zone, than by tests of other nations. (BBB)

25690 RESULTS OF THE INVESTIGATION OF THE TOTAL β ACTIVITY OF THE WATER AND AIR IN CERTAIN AREAS OF THE PACIFIC OCEAN. N. N. Alfimov, P. N. Yagovoĭ, and G. N. Novozhilov. At. Energ. (USSR), 16: 264-6(Mar. 1964). (In Russian)

In order to complete the collection of data on the specific activity of the sea water, samples were taken from the region of the Pacific Ocean delimited by the coordinates 131°57′ E to 164°00′ W longitude and 52°57′ N to 08°45′ N latitude. Immediately after taking the sample, the temperature and the salinity of the water were measured and the water was evaporated. The residue was kept in ground-glass-stoppered containers, until its activity could be measured in the laboratory, 3 months later. During July and August 1961, 18 samples were taken, 6 of them north and 12 south from the 31°30′ N latitude. The average specific activity of the water samples collected north from that parallel was 16.6×10^{-11} curie/liter; to the south of it, it was 28.2×10^{-11} curie/liter. The activity of the particulate material in the air was determined by collecting samples on adhesive paper and recording the direction and the velocity of the wind prevailing during the sampling period. The density of the radioactive fallout was determined during July, August, and November 1961. During the first period it varied between $(0.4 \text{ to } 16.3) \times 10^{-11}$ curie/m^2 day and it increased by about 2 orders of magnitude by November to $(0.5 \text{ to } 20.9) \times 10^{-9}$ curie/m^2 day. The simultaneously taken water samples also exhibited an increase by about $\frac{1}{3}$ of the original activity during the same period; the difference was probably higher because the samples were analyzed 3 months later. Correlation of the fallout activity with the wind direction indicated that the activity was highest during southeasterly and lowest during northwesterly winds. (TTT)

25691 DATING OF SOME NUCLEAR EXPLOSIONS FROM RADIOACTIVE FALL-OUT MEASUREMENTS IN CALCUTTA. Sushil Kumar Das, M. Deb Roy, and S. D. Chatterjee (Jadavpur Univ., Calcutta). Indian J. Phys., 37: 600-3(Nov. 1963).

Methods and results of measurements of the intensity and nature of radioactive fallout are presented. Samples were obtained at ground level and up to 40,000 ft. Specific explosions considered are a French test Feb. 1960 and the Russian 50 megaton Oct. 1961 test. (R.E.U.)

25692 ELUTION OF RADIOACTIVE DUST FROM THE ATMOSPHERE. K. P. Mukhon'ko. Izv. Akad. Nauk SSSR, Ser. Geofiz., No. 4, 596-603(Apr. 1964). (In Russian)

A semi-empirical formula was developed for the variations in the long-life radioactivity of rain and rain clouds. The obtained data were used for comparing and estimating fallout processes of cloud and subcloud layers. It is also shown that the radioactivity of precipitation has diminished since 1960. (R.V.J.)

25693 FALL-OUT PLUTONIUM-239 AND ZIRCONIUM-95 IN THE LUNGS OF DEER. Robert C. Pendleton (Univ. of Utah, Salt Lake City), Charles W. Mays, Ray D. Lloyd, and Norman V. Hancock. Nature, 202: 715-16(May 16, 1964).

To evaluate the inhaled fallout activity in a man-sized mammal, lungs were analyzed from Utah deer (Odocoileus h. hemionus). Plutonium-239 and ^{95}Zr were measured in deer; ^{137}Cs, ^{90}Sr, and ^{131}I in humans. Results are tabulated and compared with ICRP maximum permissible dose rates. (H.M.G.)

25694 SPECTROMETRIC DETERMINATION OF DOSE RATES FROM NATURAL AND FALL-OUT GAMMA-RADIATION IN THE UNITED STATES, 1962-63. Wayne M. Lowder, Harold L. Beck, and William J. Condon (Atomic Energy Commission, New York). Nature, 202: 745-9 (May 23, 1964).

Instrumental and analytical techniques are described that were used for spectrometric determinations of dose rates in air from natural and fallout γ radiation that contributes to environmental radiation levels in the U. S. Emphasis was placed on γ radiation from ^{40}K, the daughters of ^{226}Ra and ^{232}Th in the earth, and the ionizing component of cosmic radiation. The contribution of fallout activity was also determined. Data are summarized from measurements of both natural and fallout γ radiation made at over 200 sites throughout the U. S. during 1962 and 1963. (C.H.)

25695 VARIATIONS OF OXYGEN-18/OXYGEN-16 AND CARBON-13/CARBON-12 IN THE CALCIUM CARBONATE PLEISTOCENE VARVED CLAYS FROM TORONTO, CANADA. Jon N. Weber (Pennsylvania State Univ., University Park). Nature, 202: 791-2(May 23, 1964).

The isotopic composition of $^{18}O/^{16}O$ and $^{13}C/^{12}C$ in Ca car

bonate in Pleistocene varved clays from Toronto, Canada, was determined. The results indicate that the $CaCO_3$ of dark winter varves (average $\delta^{13}C -0.40$; average $\delta^{18}O -6.90$) was consistently enriched in ^{12}C and ^{16}O with respect to the adjacent lighter-colored, summer layers (average $\delta^{13}C -0.18$; average $\delta^{18}O -6.40$). Moreover, the C isotopic composition falls within the range of marine carbonates ($\delta^{13}C$ greater than −2 per mil) rather than that of limestones of fresh-water origin. It appears that the CO_3^{2-} in the Ca carbonate of the summer laminations from the proglacial lake was derived from pre-existing limestones without modification by isotopically lighter CO_2 produced from the decay of humus and organic matter. (P.C.H.)

25696 RADIUM AND THORIUM CONTENT IN UNDERGROUND WATER OF THE EGYPTIAN OIL FIELDS. Abdel Fattah El Nadi and M. Ammar (Cairo Univ.). Proc. Math. Phys. Soc. (U.A.R.), No. 25, 1-5(1961).

The radium and thorium contents of underground waters in the oil fields were determined by the emanation method. For radium, values ranging from 0.19 to 4.32×10^{-13} g/cm^3 were obtained. The relation between the chlorine and radium contents in the different welds considered was also studied. For thorium, values from 9.8 to 36.4×10^{-9} g/cm^3 were obtained, approximately the same as for ordinary underground waters. (D.C.W.)

25697 THE POSSIBLE HAZARD OF RADIOACTIVE STRONTIUM (^{90}Sr) AS A FALLOUT PRODUCT. J. P. Roux (Gesondheidsraad vir Buitestedelike Gebiede, Pretoria, South Africa). S. African Med. J., 36: 169-71(Mar. 3, 1962). (In Afrikaans)

Concentrations of ^{90}Sr in the biosphere, as a result of nuclear weapon testing, are discussed with reference to possible effects in present and future human populations. (BBB)

25698 FALLOUT. Chia Kim Boon (General Hospital, Singapore, Malaya). Singapore Med. J., 3: 58-61(Mar. 1962).

Fallout levels in Singapore are reported for the period after Russian nuclear weapon tests were resumed on Sept. 1, 1961. In Singspore no significant increase in radioactivity in the local atmosphere was reported in the first 30 days after resumption. Increased radioactivity was reported by the middle of November and was unusually high in the last 4 days of the month, being 39.3 times the average before the resumption on the 29th, and 28 times the next day. In contrast, radioactivity counts in Kuala Lumpur were, at their highest, 50% above the normal for the same period. On Feb. 9, 1962 it was announced locally that it was dangerous to consume rain water directly because of the very high increase of radioactive fallout over Singapore recently. Eight days later it was reported that rainwater activity, which was less than 100 $\mu\mu$C/l until the turn of the year, was 1789 $\mu\mu$C/l Jan. 31, 1962 and fell to 325 $\mu\mu$C/l on Feb. 2. Past experience with the 1958 Russian tests, also conducted in autumn, indicated that radioactivity carried up and suspended in the stratosphere descended during the next spring. The cold air cap centered over the North Pole forms, farther south, the polar front where it meets the warm air. Near the top of this front is the region of the jet streams, and it is in this region that in spring air is sucked down from the stratosphere together with the suspended radioactive fission products, to be distributed by the jet stream and washed down to earth by rain. These longer-lived fission products are spread across a broad band between latitudes 35.75°N with a peak at 35 to 40° N. Radioactivity not carried into the stratosphere is deposited within about a week after an explosion to the north of this band and is usually of short-lived activity. Therefore the equatorial and the tropical regions should get little or no fallout. In spite of the two large megaton weapons exploded at the end of October 1961, peak activities in England and United States were recorded on the 19th and 20th of September, 1961 respectively. The nature of fallout fission products and their possible hazards to man, recommended maximum permissible radiation levels, and the relation of these levels to existing radionuclide concentrations in the biosphere are discussed. (BBB)

Techniques and Equipment

Refer also to abstract 26506.

25699 (OTS-63-11008(p.15-21)) THE USE OF RADIOACTIVE ISOTOPES IN SURVEYS FOR ENGINEERING STRUCTURES. A. N. Glazov. Translated from Gidrotekhn. i Melioratsiya, 8: No. 9, 13-19(1956).

Uses of radioisotopes to determine soil compactness, solid-liquid ratios in material from suction dredges, concrete density after pouring, soil moisture content, hydrogeologic prospecting, ground water flow, coastal currents, and coastal erosion are discussed and equipment described. (M.C.G.)

25700 MASS COEFFICIENTS FOR THE ABSORPTION OF γ RADIATION IN SOILS AND THE ERROR INVOLVED IN MEASUREMENTS USING THE γ RADIATION METHOD. F. S. Zavel'skiĭ. At. Energ. (USSR), 16: 266-8(Mar. 1964). (In Russian)

The physical properties and the dynamics of the moisture changes of soils can be conveniently measured by methods involving the use of γ-active materials. It was assumed that the mass absorption coefficient μ is the same for various types of soils. This question was further examined, in view of the fact that at low photon energies μ becomes strongly energy-dependent, and the chemical composition of the soil may be of importance in this respect. Soil samples were collected from all over the Earth and divided into argillaceous and sandy categories and into subgroups, depending on the heavy element impurities present. It was found that at intermediate γ energies, E = 0.5 to 1.25 Mev, the μ values of sandy and clay soils containing up to 5% of Fe oxides do not differ by more than 0.2% in 95% of the cases; the difference between the 2 classes ranged from 0.5 to 0.7% while the μ values of the soil and of water differed by 10 to 11%. At low primary photon energies, E = 0.084 to 0.100 Mev, the μ value of the clay specimens containing up to 5% of Fe oxides was close to that of sandy soils and of water, although a scatter of 2% was observed in 95% of the cases. The μ value was found to be strongly dependent on the heavy element content of the soil. (TTT)

25701 ON THE INTERPRETATION OF TRITIUM 'AGE' MEASUREMENTS OF GROUNDWATER. A. Nir (Weizmann Inst. of Science, Rehovoth, Israel). J. Geophys. Res., 69: 2589-95(June 15, 1964).

An equation for the transit time of groundwater, based on natural tritium measurements and with consideration of the hydrodynamic dispersion coefficient of the aquifer, is derived. This equation is compared with equations based on the piston-flow and complete-mixing models. Several approximations are given, and their validity is indicated for various values of the nondimensional parameters τ and K. It is shown that the piston-flow solution is a satisfactory approximation to this equation under many commonly encountered conditions. The conditions of validity of this

solution and its geohydrological significance are discussed. (auth)

25702 ANTARCTIC SNOW CHRONOLOGY WITH Pb^{210}. G. Crozaz, E. Picciotto (Universite Libre, Brussels) and W. De Breuck. J. Geophys. Res., 69: 2597-2604(June 15, 1964).

After a short discussion on the ^{210}Pb dating method, the results of ^{210}Pb measurements on snow and firn samples from four Antarctic stations are reported as well as the experimental procedure used. ^{210}Pb was also measured in the air at ground level, at Base Roi Baudouin, the average ^{210}Pb activity of aerosols in 1958 being 1.3×10^{-3} dpm/kg of air. In samples of surface snow accumulated during the last two to five years, the average ^{210}Pb activity is of the order of 100 dph/kg of snow. This activity seems to be independent of the local rate of accumulation. The variations of ^{210}Pb activity as a function of depth were studied on two vertical firn profiles spanning an interval of more than 200 years, at Base Roi Baudouin (70°S, 24°E) and at Amundsen Scott Station (South Pole). Within experimental errors, the ^{210}Pb activity was found to decrease exponentially with depth at both stations. The most plausible interpretation is that the rate of water accumulation and the initial ^{210}Pb concentration in the snow have remained constant at both places over the last 100 years. The annual rates of water accumulation calculated from the decay curves are 6 ± 1 cm at the South Pole and 45 ± 3 cm at Base Roi Baudouin, in good agreement (to better than 10 per cent) with accumulation rates so far obtained by other methods. (auth)

25703 METHOD OF RADIOACTIVITY TRACER LOGGING. Thomas P. Hubbard and Arthur H. Youmans (to Well Surveys, Inc.). U. S. Patent 3,134,904. May 26, 1964. Filed Dec. 18, 1959.

A method of geophysical prospecting is given in which a tracer log and a natural gamma ray log are obtained simultaneously. In this method, a tracer material is used which is a gamma emitter lower in energy than a major part of the natural gamma radiation. The natural gamma log is obtained by means of a shielded detector. (D.L.C.)

Thorium and Uranium Minerals

25704 X-RAY FLUORESCENCE LEAD–URANIUM RATIO MEASUREMENTS IN ALLANITE, BANKURA DISTRICT, INDIA. S. B. Bhattacherjee and M. N. Kumar (University Coll. of Science, Calcutta). Anal. Chem., 36: 1400(June 1964).

A preliminary investigation of the mineral allanite was made to see whether the x-ray fluorescence method is satisfactory for age determination. The allanite samples analyzed came from the Madhapur-Tilaboni area, Bankura District, India. The Pb–U ratio calculated from the results was used to calculate the age of the mineral. The ag came out as equal to 1475 million years, which is in fair agreement with previous chemical analyses. (P.C.H.)

25705 TECHNETIUM IN NATURE. B. T. Kenna and P. K. Kuroda (Univ. of Arkansas, Fayetteville). J. Inorg. Nucl. Chem., 26: 493-9(Apr. 1964).

A sample of African pitchblende was found to contain between $2.5–3.1 \times 10^{-10}$ g of ^{99}Tc per kilogram ore, but no other technetium isotopes were detected. The $^{99}Tc/^{238}U$ ratio in pitchblende was about the same as the $^{99}Mo/^{238}U$ ratio in nonirradiated uranium. The experimental results suggest that the ^{99}Tc is produced in the ore predominantly by ^{238}U spontaneous fission. (auth)

HEALTH AND SAFETY

Refer also to abstracts 25037, 25055, 25073, 25265, and 25693.

25706 (AWRE-O-17/62) THE PERMEABILITY OF NEOPRENE AND POLYVINYLCHLORIDE TO HYDROGEN, DEUTERIUM AND TRITIUM. R. Hughes (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Feb. 1962. 25p.

Permeabilities were measured for all three hydrogen isotopes between temperatures of 20 and 35°C. The permeability of polyvinyl chloride was greater than that of neoprene and in general permeabilities increased in the order tritium, deuterium, hydrogen. Diffusion coefficients and solubilities were calculated for neoprene from the permeability data. Exposure of polyvinyl chloride to tritium gas for four weeks gave no change in permeability. (auth)

25707 (HW-65268(Rev.1)) HAPO IN FISSION PRODUCT SHIPPING CASK DESIGN EVALUATION REPORT. C. W. Smith (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 28, 1962. Contract AT(45-1)-1350. 72p.

The HAPO-I shipping cask was designed to meet the applicable portions of the proposed fuel element shipping regulations, to meet the requirements of the Bureau of Explosives, and to withstand two hours immersion in a fire (flame temperature 2500°F). The design criteria for the casks are complete containment of the fission products, radiation shielding to reduce the external dose rate to ICC limits, and adequate heat dissipation for all normal shipping situations and for emergency conditions which are described as impact with an unyielding surface while traveling at 44 fps followed by either complete loss of heat dissipation for 48 hours or total immersion in a fire (flame temperature 2500°F) for two hours. It was calculated that the casks will withstand satisfactorily these conditions. (auth)

25708 (HW-77962) DROP TEST OF UNBUFFERED 1/4 SIZE MODEL HAPO-IB CASK. C. W. Smith (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 30, 1963. Contract AT(45-1)-1350. 23p.

The shipping cask tested was a 1/4 size model of the HAPO-IB cask except for the diameter of the internal cavity and elimination of the internal cask components (filter, coils, etc). The cask was raised to 16 feet and dropped onto a canyon cell cover block. The model was oriented so that the center of gravity was directly above the point of impact, which was the edge of the cupola containing the process connections. During the impact, the bolts holding the cupola cover were sheared off although the cupola cover did not fall off. After initial impact, the cask rebounded, fell off the cover block and landed on the top again. The process connection cupola cover fell off but all the primary and secondary closures were in place, although the middle secondary closure could be moved slightly. Damage to the cask top, the cupola cover, and the cover block are shown. (auth)

25709 (NDL-TR-49) EVALUATION OF INTERNAL RADIAC DETECTOR POSITIONS FOR AN M60 TANK. Ralph E. Rexroad, Murray A. Schmoke, and John L. Meredith (Army Nuclear Defense Lab., Edgewood Arsenal, Md.). Apr. 1964. 48p.

The optimum position of a radiac detector within an M60 tank to provide a radiation survey and detection capability in a residual-gamma-radiation field was determined. Correction factors pertinent to such an internal detector to yield the free-field dose rate are given. The best site was found to be in the turret-rear top position; the next choice was in the turret-front position. (auth)

25710 (NP-13984) MEASUREMENTS OF CAESIUM-137 IN FINNISH LAPPS IN 1962-63 BY A MOBILE WHOLE BODY COUNTER. Jorma K. Miettinen (Helsinki. Univ.). [1963]. 12p.

The design and calibration are described of a portable whole-body counter used to measure radioactivity in Finnish Lapps. Data are presented on the ^{137}Cs content of three groups of Lapps counted in 1962, 1963, and 1964. The high ^{137}Cs content of two of the groups was related to the consumption of reindeer meat and river fish. The data are compared with results of measurements on Swedish Lapps and Alaskan Eskimos. The situation in Scandinavia and Alaska appears to be similar. Average body burdens of ^{137}Cs for adult Finnish Lapps in April 1964 were calculated to be 890 nC for males and 400 nC for females, corresponding to total-body radiation doses of approximately 80 and 35 mrem/yr, which are close to the MPC-value of ICRP for individuals of the general population. Values in Finland were 790 nC, in Sweden 740 nC and in one group of Eskimos 498 nC ^{137}Cs. It is pointed out that these same population groups have an average body burden of the natural radionuclides RaD and RaF about 10 times higher than normal. (C.H.)

25711 (ORNL-3441) THEORETICAL POSSIBILITIES AND CONSEQUENCES OF MAJOR ACCIDENTS IN U^{233} AND Pu^{239} FUEL FABRICATION AND RADIOISOTOPE PROCESSING PLANTS. C. E. Guthrie and J. P. Nichols (Oak Ridge National Lab., Tenn.). Apr. 1964. Contract W-7405-eng-26. 152p.

Radioisotope source fabrication and ^{239}Pu and ^{233}U fuel fabrication in privately owned radiochemical plants are expected to increase greatly during the next decade. Inventories of specific isotopes in plants of the future may be factors of 2 to 1000 larger than those common in today's plants. The potential economic loss from off-site damage due to theoretical accidents in such future plants was evaluated. With the containment and engineered safeguards included in radiochemical plants it was concluded that accidents having more than a theoretical possibility of occurring would not result in a monetary loss due to damage to the surroundings in excess of the limits of private insurance now available ($60,000,000). It is possible to postulate accidents in plants processing the more hazardous isotopes (e.g., ^{90}Sr, ^{238}Pu, ^{239}Pu, ^{244}Cm) which would theoretically result in off-site damage in excess of $60,000,000. Such accidents, however, have such an extremely low probability of occurrence as to be considered incredible. On the other hand, in plants processing some isotopes (e.g., ^{85}Kr, ^{131}I, ^{147}Pm) even the most severe accident imaginable (100% release during unfavorable weather) would not be expected to result in a loss of more than a few million dollars. (auth)

25712 (USNRDL-TR-722) MEASUREMENTS OF THE EFFECTS OF COMPARTMENTALIZATION ON THE GAMMA-RAY AND NEUTRON DOSE RATE IN THE RADIATION FIELD OF A REACTOR. W. E. Thompson and F. C. Engesser (Naval Radiological Defense Lab., San Francisco). Feb. 17, 1964. 55p. (AD-437994)

Data illustrating the effects of various components of a simply compartmented structure on the dose-rate field near a reactor were gathered at the Tower Shielding Facility of Oak Ridge National Laboratory and are presented in forms allowing convenient comparisons between gamma-ray and neutron dose rates for given configurations. These effects were found to be nearly equivalent to the additive effects of the sides of the compartment considered separately, thus adding credence to the assumption that each slab contributes to the total dose rate independently. By weighting these contributions according to solid angle, a method is worked out which consistently predicts the dose rate for any configurations not involving double transmission. (auth)

25713 (VDDIT-89) TRANSPORTATION OF RADIOACTIVE MATERIALS. PROGRESS OF EQUIPMENT AND INTERNATIONAL REGULATIONS. A Literature Survey. Anders Nystroem (Aktiebolaget Atomenergi, Stockholm). Apr. 1964. 49p.

One hundred and eighteen references on shipping of radioactive materials were compiled from Nuclear Science Abstracts, 1959 through March 1964. A coordinate subject index is included. (M.C.G.)

25714 NUTRITIONAL QUALITY OF SURVIVAL BISCUITS AND CRACKERS. John H. Browne (State of New York Dept. of Health, Albany). Am. J. Clin. Nutr., 14: 179 (Mar. 1964).

It is pointed out that persons who take refuge in fallout shelters for protection against lethal levels of radiation may face the additional hazard of a shortage of drinking water. Even with the stockage of two quarts of water per person per day, a minimal allowance recommended for this purpose, occupancy of the shelter by more than the intended number, confinement in the shelter for longer than anticipated, and high environmental temperature could create a shortage of water. Since certain combinations of food may accelerate water loss under survival conditions even more than complete starvation, the optimal ration under such circumstances is one which will not impair the water economy of the body. Survival biscuits and crackers which were designed to provide minimum nutritional needs, except for water, during a 2-week period in a fallout shelter, were also designed to meet the requirements of a survival situation in which water could be a limiting factor. However, the nutritional quality of survival biscuits and crackers is not optimal, as shown by studies in rats. In rats when a nutritionally improved (lysine added) diet was fed, the ad libitum water intake increased, as did ad libitum food intake. An increased requirement in fluid intake is to be avoided in a survival situation in which water may be in short supply. Thus a study should be conducted with diets and the lysine supplement fed at isocaloric levels instead of ad libitum. Also, rats studied over a 4-week period should provide data corresponding to a 2.8-yr period for man (on the basis of life spans of 700 days and 70 yr for rat and man), so that these data are not strictly applicable to an expected 2-week shelter experience for man. (BBB)

25715 CURRENT STATUS OF ATOMIC ENERGY COMMISSION-STATE COOPERATIVE PROGRAM. G. W. Morgan (Atomic Energy Commission, Washington, D. C.). Am. J. Public Health, 53: 878-81(June 1963).

Assumption of broader responsibilities for radiation protection by the states through agreements between the states and the Atomic Energy Commission is discussed. Each agreement between the Commission and a state contains provisions under which both the state and the Commission commit themselves to cooperate in maintaining continuing compatibility of regulatory programs for the regulation of like materials. The agreements also provide for exchange of information and comments on proposed changes in their respective rules and regulations and in their licensing, inspection, and enforcement policies and criteria. The State-AEC Relations Branch, Division of Radiation Protection Standards, serves as the focal point in dealing with the states in developing enabling legislation, in developing and submitting regulations, and in the development and implementation of complete regulatory programs. The additional staff for increased regulatory responsibilities by the agreement states has increased their competence in the field of radiation protection. To assist the state and local officials in increasing their competence in the field of radiation protection, the AEC provides two types of training courses. Cooperation of municipal and local authorities with the AEC, particularly on regulations involving the transport of radioactive materials is also considered. (BBB)

25716 PROFESSIONAL SELECTION OF PERSONNEL FOR WORK WITH IONIZING RADIATION. B. Prpic (Inst. for Medical Research and Occupational Medicine, Zagreb). Arhiv Hig. Rada Toksikol., 14: 241-4(1963).

Potential criteria for selection and eligibility standards from the psychological and medical standpoint in assigning persons to work involving exposure and handling of radioactive materials are discussed. Differentiations between temporary and full-time work, medical protection, and accident prevention, and related aspects are included. (OTS)

25717 EVALUATION OF AVERAGE DOSE OF IONIZING RADIATION IN OCCUPATIONALLY EXPOSED PERSONS. B. Prpic, H. Cerovac, and Lj. Despotovic (Inst. for Medical Research and Occupational Medicine, Zagreb). Arhiv Hig. Rada Toksikol., 14: 245-9(1963).

During three years, film dosimeter records were collected on 654 persons professionally exposed in 42 medical facilities. The data are tabulated according to various criteria and discussed with particular reference to relative effectiveness of various medical protective measures. (OTS)

25718 PRINCIPLES OF AIR CIRCULATION IN OPERATIONAL AREAS OF HIGH-LEVEL γ INSTALLATIONS. N. V. Sobol, A. A. Petushkov, and A. Kh. Breger. At. Energ. (USSR), 16: 262-4(Mar. 1964). (In Russian)

The circulation air in buildings in which high-level radiation studies are carried out presents some safety problems. The ionizing radiation results in the formation of N oxides and ozone, requiring frequent air changes. Formulas were derived for calculating the required air flow on the basis of the maximum permissible concentration (MPC) of the radiation-generated harmful components. The final radioinduced oxidation products of the atmospheric N are NO_2 and N_2O with yields of 1.45 and 0.62 molecules, respectively, per 100 ev of absorbed radiation at 20°C and atmospheric pressure. The measurements showed that the NO_2 content of the total oxides may vary from 37 to 83%. It was found within an error of ±5% that 1 rad of radiation in 1 liter of air causes the formation of 1.54×10^{-7} mg of N

oxides. This agrees with previous data; however, the data on the ozone yield are contradictory. It was found that the O_3 content is always about 30 times smaller than the N oxide concentration; at the same time the MPC of O_3 is about 50 times lower than that of the N oxides; therefore, the concentration of the latter controls the air flow requirements. The calculations showed that the needed air circulation is $L = 1 \times 10^{-3} AV^{\frac{1}{3}}$ m³/hr, where A is the γ activity in g. equiv. of Ra and V is the volume of the room. However, it should be kept in mind that other harmful materials may be created by radiation and may reach the atmosphere of the room. (TTT)

25719 REDUCING RADIATION HAZARDS IN THE RADIUM WARDS. Patricia Howes and S. B. Osborn (Univ. of London). Brit. Med. J., 2: 448-51(Aug. 18, 1962).

It is noted that one of the most difficult aspects of radiation safety in a hospital is the protection of ward nursing staff during the therapeutic use of Ra. Large quantities of Ra may be used, and such patients must receive nursing attention many times, under circumstances which prevent shielding according to standard practices. A study of this problem, as it affects a ward where gynecological Ra treatments are carried out, was conducted. In the 10-bed ward covered by this survey about 60 Ra treatments were given. Only on rare occasions in this ward, even at the start of the survey, had any member of the nursing staff received a dose as high as 300 mr in a week, or a total exceeding 1 r in 13 weeks. A table shows the amount of radiation received, as mr/1000 mg-hr of Ra treatment; the total dosage received by the nursing staff during a period of over 3 years is shown, quarter by quarter. The radiation received was evaluated separately for the nurse in charge of the ward, her deputy, and junior nurses. From 1958, when the survey was begun, to 1961 the total dose received by the nursing staff was reduced from 213 to 78 mr/yr/1000 mg-hr. A detailed analysis was made, by a work-study technique and the use of film badges, of the doses received during various nursing duties. The steps responsible for the reductions in radiation hazards are listed. (BBB)

25720 EMERGENCY FIELD SANITATION. Mark Flattery (Environmental Sanitation, Province of Manitoba, Winnipeg). Can. J. Public Health, 54: 431-6(Sept. 1963).

Sanitation problems that would arise following a thermonuclear attack are envisioned and ways to meet them are outlined. It is concluded that the problems of field sanitation are not too difficult to solve provided they are dealt with promptly and are properly planned. (BBB)

25721 FILM DOSIMETRY IN A RADIOLOGY DEPARTMENT: ATTEMPT AT A PSYCHOLOGIC APPROACH. V. Hajek and F. Sedlacek (Vojenská Nemocnice, Ružomberku, Czechoslovakia). Cesk. Rentgenol., 17: 206-12 (May 1963). (In Czech)

In an attempt to demonstrate to technicians working in a radiology department of a hospital the extent of stray radiation and the effectiveness of protective measures, dental films were distributed at various sites in the working area during different procedures. The film-blackening effect obtained appeared to provide adequate evidence of the extent of exposure possible where safety precautions are not enforced. Doses encountered in various radiologic procedures using different x-ray intensities are tabulated. (BBB)

25722 A COMPARATIVE ANALYSIS OF SOME OF THE IMMEDIATE ENVIRONMENTAL EFFECTS AT HIROSHIMA AND NAGASAKI. Clayton S. White, I. G. Bowen, and Donald R. Richmond (Lovelace Foundation, Albuquerque, N. Mex.). Health Phys., 10: 89-150(Mar. 1964). (CEX-63.7; CONF-67-30)

The problem areas of concern to those who would establish a quantitative relation between biologic response and the more immediate environmental variations caused by nuclear explosions are defined. The scope of blast and shock biology is reviewed and a selective summary of current knowledge regarding biological blast effects is presented. Tentative criteria useful in assessing the hazards of some of the major nuclear effects are noted. Following elucidation of the range-yield-effects relation applicable to high-yield explosions generally, the criteria are applied specifically to a 20-kton yield burst at heights assumed to apply to the Hiroshima and Nagasaki explosions. The procedure, establishing the range-effect relation for the two Japanese cities, was carried out through use of the free-field scaling laws and a mathematical model allowing scaling of translational effects for both debris and man. Thus an attempt was made to predict the ranges inside which the potential existed for producing specified levels of biological damage. For each of the predicted ranges, values for overpressure, thermal, and initial nuclear radiations along with translational velocities for man and glass fragments were computed to allow a more balanced appreciation of all the effects parameters that pose a hazard to man. The implications of the free-field range-effects data in interpreting some of the immediate effects at Hiroshima and Nagasaki were explored and discussed. Though the overall analytical approach followed was thought to be useful and sound, the tentative nature of many of the numerical data presented is emphasized. Thus those numbers employed representing best current estimates as well as values arbitrarily assigned were all noted to be subject to future refinement as new information expands the understanding of nuclear phenomenology and the consequences of exposure thereto. (auth)

25723 ENVIRONMENTAL MONITORING ASSOCIATED WITH THE DISCHARGE OF LOW ACTIVITY RADIOACTIVE WASTE FROM WINDSCALE WORKS TO THE IRISH SEA. H. J. Dunster (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.), R. J. Garner, H. Howells, and L. F. U. Wix. Health Phys., 10: 353-62(May 1964).

Since 1952, low activity radioactive waste has been discharged by pipeline from Windscale Works to the Irish Sea off Sellafield. Environmental monitoring studies have been carried out throughout this period in order to assess the resultant radiation dose to man, and hence to estimate the discharge rate which would correspond to the maximum permissible radiation doses recommended by the International Commission on Radiological Protection. These studies have been concerned principally with those materials most likely to contribute substantially to the dose to man, and they have been supplemented by more widespread marine surveys and by laboratory studies aimed at gaining information about the movement and behavior of radioactive nuclides in the marine environment. It has been concluded from these studies that the rate of discharge from Windscale Works to the Irish Sea cannot be permitted to exceed about 100,000 C/month of mixed fission products, and that specific restrictions are needed on a number of individual nuclides, namely, ^{90}Sr (about 2000 C/month), ^{106}Ru (about 5000 C/month), and ^{144}Ce (about 20,000 C/month). The present discharge rates are about 4000 C/month of mixed fission products, of which about half is ^{106}Ru and about 2% ^{90}Sr. (auth)

25724 DECONTAMINATION OF SURFACES CONTAMINATED WITH RADIOACTIVE ISOTOPES. J. Flattau and Z. Smal (Central Inst. for Labor Defense, Warsaw). Kernenergie, 7: 236-42(Apr. 1964). (In German)

Methods of decontamination of surfaces contaminated with radioactive material are reviewed. The influence of the most important parameters on the effectiveness of decontamination was investigated. The effectiveness of the decontamination of polyvinyl chloride materials using customary agents such as mineral acids, citric acid, soda solutions, detergents, etc. is given. (tr-auth)

25725 ON RADIATION PROTECTION IN INDUSTRIAL APPLICATION OF RADIOACTIVE TRACERS. E. Bujdosó (Research Inst. for Nonferrous Metals, Budapest). Kernenergie, 7: 242-9(Apr. 1964). (In German)

A method for determining maximum permissible indicator amounts for industrial investigations with radioactive indicators is presented. The relationships in series-connected containers and in piping were investigated and the different mixing possibilities were considered. Apparatus for incorporating the tracer into the process stream are discussed. (tr-auth)

25726 EXPERIENCE GAINED WITH MOBILE WATER PURIFICATION PLANT. R. Brylka (Fried. Krupp Baubetriebe, Essen). Krupp Tech. Rev. (English Transl. Tech. Mitt. Krupp., Werksber.), 22: 39-48(Apr. 1964).

Mobile water purification equipment has been used to an increasing extent in recent years, particularly in disaster areas and emergencies. Fried. Krupp Baubetriebe, an independent division in the Krupp organization, have developed and field-tested three different types of such equipment—a mobile water purifier, a decontamination unit, and a de-oiling unit. The mobile water purifier was successfully used in the tropics, in flooded areas, and at subzero temperatures in treating badly polluted river water. The decontamination unit also proved entirely satisfactory in removing radioactivity from water, and the de-oiling unit, provided with a new type of filter material, yielded good results in cleaning oil-polluted water even at low temperatures. (auth)

25727 RADIOACTIVITY IN MILK AND BONE. Geoffrey Taylor (Cricket Malherbie, Ilminster, Eng.). Lancet, 2: 833-4(Oct. 19, 1963).

The possibility of preventing milk containing relatively high levels of ^{131}I and ^{90}Sr from so-called special areas in the United Kingdom where rainfall is high and fallout up to five times the national average, from being fed to children is discussed. Also discussed is the question of whether the U. K. should report fallout levels more promptly and frequently, such as on a monthly basis as done in Canada and some other nations. British fallout levels are comparable to the Canadian figures, except that with half-yearly or yearly reports, the British information comes 6 to 12 months later. A recent Canadian report shows that it is probable that milk in areas of high fallout in Britain contains radiostrontium above a level of 134 $\mu\mu C/l$ and possibly considerably above this. This means that amounts of radiostrontium in the bones of infants who are drinking milk from rainy areas may well be above the 33.5 $\mu\mu C/g$ Ca of the Medical Research Council's warning level and the 67 $\mu\mu C/g$ Ca which is the maximum permissible level in the whole population allowed by the International Commission on Radiobiological Protection. The Canadian report indicates that the bone dose from the short-lived ^{89}Sr, which has been at a high level during the past year, is comparable to that from ^{90}Sr. Attempts are made to compare the rise in the radiation dose from fallout with the decrease in the dose from x-ray exposures. Since the Adrian Report, recommending the avoidance of all unnecessary exposure to x rays, these exposures in some cases have been reduced in three yr by $^2/_3$, and special precautions are taken to avoid, if possible, all exposure to pregnant women and to children. During the same period, exposure of young children to radiation from fallout has more than doubled and is now a major source of man-made radiation exposure. With nuclear fallout now at maximum levels, there may be a hazard in milk from certain areas. Some of this milk is dried for infant foods, and may be given to infants for a year or more. Cans of it may have a long shelf-life. (BBB)

25728 THE OCCURRENCES OF LEUKEMIA IN THE PEOPLE EXPOSED TO THE ATOMIC BOMB EXPLOSIONS AND RELATED PROBLEMS. Masanobu Tomonaga (Hiroshima Univ.). Sogo Igaku, 20: 561-6(Aug. 1963). (In Japanese)

Occurrences of leukemia in Hiroshima and Nagasaki and other related matters are described in the following sections: the occurrence per year of leukemia; the relation between the distance from the center of explosion and the occurrence; the relation between the exposure dose and the occurrence; the incubation period; the types of leukemia; the relation with the occurrence expectancy; the occurrence of leukemia at very low doses; conclusions. In the areas within 2000 m of the center, the occurrence reached a peak in 1950 to 1952. The rate of occurrence started to increase 1.5 to 2 years after the explosion and gradually decreased after the peak. The occurrence is larger closer to the center. Within 1000 m of the center, occurrence was more than 50 times the average of the country, but outside the 2000 m circle, it was not much different from the average. Calculations showed that, above about 100 rad, there is a linear relation between dose received and occurrence. The incubation period was shorter closer to the center of the explosion. Leukemia is the one post-explosion disorder for which the relation between cause and effect was most clearly shown. It can only be said definitely at present that radiation can cause leukemia in human beings and that there is a parallel relation between dose received and occurrence. (Nucl. Sci. Abstracts of Japan, 3: (Apr. 1964))

25729 MILITARY MEDICAL SERVICES AND THE PHYSICIANS. T. Dale. Tidsskr. Norske Laegeforen., 83: 923-6(June 1, 1963). (In Norwegian)

The aims of the Military Medical Services and their organization for war are outlined. The role of the Medical Officer against the background of the basic principles of the service is touched upon. It is pointed out that the Medical Services, by having facilities for taking care of thousands of causalties at short notice and within a very short time, have developed methods and procedures which are useful in the planning of the treatment of mass casualties among civilian populations resulting from a nuclear attack. (BBB)

25730 MEDICAL PROBLEMS RESULTING FROM RADIOACTIVE FALLOUT. L. Eldjarn. Tidsskr. Norske Laegeforen., 83: 937-45(June 1, 1963). (In Norwegian)

A review is given of the medical and public health problems that would presumably arise from exposure of population groups to radioactive fallout in an emergency. Particular emphasis is laid on the existing recommendations concerning maximum permissible doses, acceptable doses and accidental high exposure doses that were worked out by

various national and international bodies dealing with radiologic health. (BBB)

25731 PATHOLOGIC PSYCHOLOGIC REACTIONS TO DISASTERS AND THEIR TREATMENT. L. Eitinger. Tidsskr. Norske Laegeforen., 83: 964-6(June 1, 1963). (In Norwegian)

A survey concerning the most important psychologic reactions that may be expected after disasters is given and their first-aid treatment described briefly. Emphasis is laid on the prevention of panic situations. (BBB)

25732 THE PROFESSION AND NUCLEAR WARFARE. J. M. Mitchell. Vet. Record., 76: 135(Jan. 25, 1964).

The probable fate of farm animals in a thermonuclear attack is discussed and the value of civil defense training for veterinarians is briefly commented on. (BBB)

25733 UNIFORM RADIATION PROTECTION AT LAST. W. Baeck. Zentr. Arbeitsmed. Arbeitsschutz, 11: 77-81 (Apr. 1961). (In German)

A new uniform law for the peaceful uses of atomic energy and protection against its hazards has become effective recently. According to this law, the annual radiation dose should not exceed 1.5 r/yr for persons who are engaged in radiation work. The maximum permissible dose should not exceed 5 r/yr for persons between the ages of 18 and 38 yr, so that the total dose should not exceed 100 r for this period of time. The total dose for any 13 consecutive weeks must not exceed 3 r, but the annual limit of 5 r should not be exceeded in any case. The law permits greater doses for the hands, arms, feet, and ankles, and for persons whose occupations do not require exposure to radiation. Maximum permissible concentrations of radioisotopes in air, water, and soil are prescribed. For example, in water the concentration of ^{60}Co should not exceed 3×10^{-4} $\mu C/cm^3$. Radioactive wastes must be disposed of as designated by appropriate authority. Before a radioactive material can be used, the user must be investigated. The initial investigation must be followed up after 6 months with a second investigation. Special permission is required for studies where the single radiation dose amounts to as much as 25 r, or where the incorporation of radioactive materials into the body is planned. These investigations are to be carried out by physicians. Applications for authorization to use radioisotopes or radiation must be filed with the proper authorities under this new law even though the user had been authorized previously under another law. The previous authorization may be used until confirmed again. Violations of the new law are punishable by fines or imprisonment or both. (BBB)

25734 ON RADIATION PROTECTION IN THE MEDICAL APPLICATION OF RADIUM. Hanns-Joachim Koerner (Mess- und Pruefstelle fur die Gewerbeufsichtsverwaltung des Landes Hessen, Kassel, Ger.). Zentr. Arbeitsmed. Arbeitschutz, 12: 187-90(Aug. 1962). (In German)

In gynecologic radiation therapy with Ra, several precautionary measures are necessary to prevent injury to medical personnel. All rooms where sealed Ra sources are used should be situated in areas separate from other parts of the hospital. A safe should be used for storage of the radioactive material, and the dose intensity 10 cm from its surface should not exceed 2.5 mr/hr. The Ra source should be contained in a shield so that it can be removed and transported safely. A table should be available for preparation and packing of the Ra; this should be located close to the storage safe. Personnel should wear body shields with a Pb equivalent of about 12 cm. Observation windows should have Pb equivalents of about 4 cm. Patients should be assigned to single rooms, and the dose intensity 10 cm from the wall surface of the adjacent hall, floors, and ceiling should not be more than 0.2 mr/hr. Radium capsules should be handled with metal tongs so that they are kept at a distance of 30 cm from the hands. The prepared Ra implant should be delivered to the physician just before it is to be used. Shields with Pb equivalent of 5 cm should be used by nursing personnel. The patient should be transported as rapidly as possible, keeping in mind that the dose from intrauterine implants is greater at the feet than at the head of the patient. The Ra containers should be inspected for leakage annually, and repaired when needed. Radiation meters that can be read to 0.1 mr/hr, finger rings, film badges, and pocket dosimeters should be used by personnel. Patient treatment rooms should be cleaned only when empty. (BBB)

25735 ASSAY OF STRONTIUM-90 IN HUMAN BONE IN THE UNITED KINGDOM. RESULTS FOR 1963, PART I. Medical Research Council Monitoring Report Series No. 8. (Gt. Brit. Medical Research Council, London). Feb. 1964. 13p. $0.30(BIS); 1s. 6d. (HMSO)

Data are presented on the ^{90}Sr content in samples of human bone from subjects who died in Great Britain during the first half of 1963. Data for the corresponding months in 1962 are included for comparison. (C.H.)

25736 IMPROVEMENTS IN OR RELATING TO CONTAINERS FOR USE IN HANDLING RADIO-ACTIVE MATERIALS. John Bishop (to United Kingdom Atomic Energy Authority). British Patent 958,812. May 27, 1964. Filed Sept. 28, 1961.

A shielded container for radioactive materials is designed with means for moving it about. The container comprises a cylindrical body with an aperture for housing radioactive material, a detachable closure member closing the aperture, and wheels carrying the body. The wheels shroud the body to provide additional shielding, and the adjacent surfaces of the body and wheels are curved to reduce radiation scattering. (D.L.C.)

25737 IMPROVEMENTS IN OR RELATING TO POWDERS FOR EXTINGUISHING FIRES. Harry Thomas Hall (to United Kingdom Atomic Energy Authority). British Patent 960,007. June 10, 1964. Filed Mar. 2, 1961.

A fire-extinguishing powder is described which is useful for fires of U, Pu, and/or Th, particularly Pu fires in a sealed working space. The powder comprises a mixture of alkali metal fluorides and/or CaF_2, which has a melting point below 500°C. The mixture is prepared by fusing together the constituents and grinding to a powder. Several ways of discharging the powder over a fire and several typical powder compositions are given. (D.L.C.)

INSTRUMENTATION

General

Refer also to abstract 26113.

25738 (BNL-8006) FERROELECTRIC HYSTERESIS BRIDGE. J. F. Jacobs (Brookhaven National Lab., Tenn.). Apr. 21, 1964. Contract AT-30-2-GEN-16. 17p.

The circuitry for the oscillator, power amplifier, differential amplifier, peak voltmeter, and power supplies is shown. The bridge is a transistorized version of a previous instrument. The bridge features direct reading of dielectric properties such as spontaneous polarization, applied voltage, coercive field, conductance, and residual capacity. (R.E.U.)

25739 (CONF-182-16) PLANAR DYNODE MULTIPLIERS FOR HIGH-SPEED COUNTING. W. W. Sapp (Westinghouse Electric Corp. Electronic Tube Div., Elmira, N. Y.) and E. J. Sternglass (Westinghouse Electric Corp. Research Labs., Pittsburgh). Feb. 26, 1964. Contract [AT(30-1)-2825]. 16p.

From the 9th Scintillation and Semiconductor Counter Symposium, Washington, D. C., Feb. 1964.

A high-speed electron multiplier using a planar dynode configuration is discussed. This multiplier has a total transit time significantly shorter than available in conventional structures of equivalent gain. It also features rise-times generally less than three nanoseconds while providing the large sensitive area of an unfocussed configuration. Two basic types of planar dynodes are employed: transmission secondary emission thin films as the early multiplier stages, and silver-magnesium modified mesh multipliers as the high current output stages. The relevant gain and pulse-response data for these two types of dynodes are presented. The structure is quite flexible and permits the number and types of dynodes to be easily tailored to a specific application. In particular it will be shown how the number of mesh-type dynodes may be altered to effect a trade-off between current handling capabilities and rise-time characteristics. Several possible combinations of these planar dynodes have been incorporated in photomultipliers whose gain, dark current, pulse response, and operating life are discussed. (auth)

25740 (EANDC(UK)-25L) MASS SPECTROMETER AND ISOTOPE SEPARATOR FACILITIES AT A.E.R.E. R. W. McIlroy (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Mar. 1964. 2p.

Characteristics of the mass separators S.E.M., HERMES, and L.E.M. are listed. Mass spectrometer facilities and their uses are listed. (R.E.U.)

25741 (N64-13153) FIELD EFFECT TRANSISTORS. COMPARATIVE EFFECTS OF 1 Mev ELECTRON IRRADIATION ON FIELD EFFECT AND INJECTION TRANSISTORS. Technical Bulletin No. 1. C. S. Roberts and J. A. Hoerni (Amelco Semiconductor. Div. of Teledyne, Inc., Mountain View, Calif.). Mar. 1963. 5p.

Degradation characteristics of semiconductor devices under electron irradiation similar to that found in high-altitude radiation belts show that the field-effect transistor will still be operable at total dosages between 1000 and 10000 times greater than will be endurable with conventional high-gain injection transistors. The degradation of the latter is particularly severe at the low collector current levels used for high input impedance applications. (auth)

25742 (NAS-NRC-Pub-1184(p.23-35)) INFORMATION PROCESSING EQUIPMENT FOR PHYSICS RESEARCH AT CHALK RIVER. J. Leng (Atomic Energy of Canada Ltd., Chalk River, Ont.).

The development of digital data processing systems at Chalk River is discussed. Accelerator- and reactor-associated facilities are described. Computer facilities are summarized. (R.E.U.)

25743 (NAS-NRC-Pub-1184(p.36-7)) INFORMATION PROCESSING SYSTEMS AT BROOKHAVEN. R. L. Chase (Brookhaven National Lab., Upton, N. Y.).

Present facilities and developments for future projects in the field of analyzers are discussed. (R.E.U.)

25744 (NAS-NRC-Pub-1184(p.38-9)) INFORMATION PROCESSING SYSTEMS AT ARGONNE. M. Strauss (Argonne National Lab., Ill.).

Some applications of computers at ANL are discussed. (R.E.U.)

25745 (NAS-NRC-Pub-1184(p.40-1)) A SURVEY OF ANALYZER SYSTEMS AT ORNL. J. W. Woody, Jr. (Oak Ridge National Lab., Tenn.).

Analyzer systems in use at ORNL for fission fragment and neutron experiments are described. (R.E.U.)

25746 (NAS-NRC-Pub-1184(p.292-5)) LIMITING FACTORS IN THE USE OF STORAGE TUBES AS TEMPORARY STORES FOR PULSE AMPLITUDES. K. Kandiah (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

Amplitude- and time-resolution, storage position numbers, read-out rates, and dead-times are considered as limiting factors in the use of electrostatic memory tubes for pulse amplitudes. (R.E.U.)

25747 (NAS-NRC-Pub-1184(p.296-304)) MAGNETIC TAPE SYSTEMS AT HARWELL. K. Kandiah (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

Magnetic tape systems and their performance are discussed. (R.E.U.)

25748 (NAS-NRC-Pub-1184(p.320-1)) A DIRECT 3-D DISPLAY. D. A. Mack (California. Univ., Berkeley. Lawrence Radiation Lab.).

The development of a direct-view 3-dimensional cathode-ray tube, which displays volumetric analog information directly, is reported. (R.E.U.)

25749 (ORNL-3582(p.40-1)) AN IMPROVED ELECTRON MICROSCOPE FOR DETERMINATION OF MOLECULAR STRUCTURE. T. A. Welton and J. Kronsbein (Oak Ridge National Lab., Tenn.).

It has been demonstrated that the cubic aperture defect of an electron lens can be precisely eliminated by use of an annular optical system. An electron microscope with 1 Å transverse and longitudinal resolution, capable of molecular structure determination, therefore appears to be feasible. (auth)

25750 (PAN-459/XVI) THERMOSTAT MIT 0,0005° REGELGENAUIGKEIT. (Thermostat With 0.0005° Regulation Accuracy). Anatol Selecki and Jan Graczyk (Polish

Academy of Sciences. Inst. of Nuclear Research, Warsaw). 1963. 10p.

A thermostatic arrangement with high regulation accuracy for carrying out densimetric isotopic analyses of deuterium and ^{18}O is described. The temperature constant amounted to 5×10^{-4}°C. (tr-auth)

25751 BETA GAUGE MEASURES THIN METALLIC FILMS. Can. Chem. Process., 48: No. 4, 73, 76(Apr. 1964).

A versatile new means of testing thickness of thin metallic films was developed. The instrument is applicable to coatings as diverse as Cu on phenolic board, Cr on Ni, and anodized Al. Trade named Betascope, the instrument determines coating thickness by careful measurement of the amount of beta radiation reflected or backscattered from a sample under irradiation by a small radioactive source. Operation and application of the Betascope are discussed. (P.C.H.)

25752 THE POISONING AND ACTIVATION OF THORIA-COATED FILAMENT EMITTERS. W. G. Trodden and R. O. Jenkins (General Electric Co., Ltd., Wembley, Eng.). J. Electron. Control (1), 16: 407-23(Apr. 1964).

The activation and poisoning of thoria-coated Ir and W filament emitters were experimentally investigaged. It was found that activation is by the formation of free Th. Pulse emissions arise from both the coating and core surfaces. But under d-c conditions the coating surface is deactivated and the emission arises mainly from the core surface. Poisoning is caused by OH_2O vapor, and CO_2, but not by H and CO. The coated W resists poisoning better than the Ir, as free Th is formed chemically by the former but not by the latter. Taking d-c emission from either filament produces Th electrolytically, giving an increased resistance to poisoning. Some of the Th so produced dissolves into the Ir core and subsequently increases the resistance to poisoning. The coated Ir filament can withstand exposure to the atmosphere when hot without appreciable deterioration. (auth)

25753 A TRANSISTORIZED HIGH-RESOLUTION TIME ANALYZER FOR DETERMINING THE HALF-LIFE OF SHORT-LIVED ACTIVITIES. H. Doehler and G. Lang (Zentral-institut fur Kernforschung, Rossendorf, Ger.). Kernenergie, 7: 226-30(Apr. 1964). (In German)

The operation of a completely transistorized 32-channel time analyzer is described, whose dead time is smaller than 10^{-6} sec. Its chief component is a ferrite-core storage, which is attained by special connection measures so that its storage processes take place outside the actual channel opening time. After explanation of the manner of operation of the storage, the total function of the apparatus was examined on the basis of a block diagram. (tr-auth)

25754 RESPONSE TIME OF "THERMOCOAX." R. Schroeder. Kerntechnik, 6: 174-6(Apr. 1964). (In German)

The response time of the Thermocoax miniature-mantle thermoelement was studied. Results are presented in graphs. (M.C.G.)

25755 SIMPLEST REVERSIBLE DECIMAL COUNTERS. G. Bendiscioli (Universita, Pavia, Italy and Istituto Nazionale di Fisica Nucleare, Pavia, Italy), G. Boella, and G. Degli Antoni. Nuovo Cimento (10), 32: 769-77(May 1, 1964). (In Italian)

The logical design of the simplest reversible decimal counters in binary code is described. The proposed schemes were obtained by analyzing almost every possibility offered by four flip-flops arranged either in series or in parallel. (auth)

25756 THE EFFECTS OF NEUTRON RADIATION ON SECONDARY BREAKDOWN. E. B. Hakim and B. Reich (Army Electronics Research and Development Labs., Fort Monmouth, N. J.). Proc. IEEE (Inst. Elec. Electron. Engrs.), 52: 735(June 1964).

The secondary breakdown current level I in silicon N-P-N single-diffused transistors was found to be reduced by neutron radiation. The decrease was greatest in units receiving the largest dosage. Total recovery was achieved in about 72 hours of annealing at 200°C. The decrease in I with radiation is attributed to an increase of minority carriers in the base of the transistor, resulting in severe current crowding and localized hot spots. (D.C.W.)

25757 ORBITRON IONIZATION GAUGE. W. G. Mourad, T. Pauly, and R. G. Herb (Univ. of Wisconsin, Madison). Rev. Sci. Instr., 35: 661-5(June 1964).

An ion gauge with high ionization efficency and low input power is described. Electrons are injected by a small tungsten filament into the electrostatic field between two concentric cylinders, with energies and angular momenta such that a relatively long mean free path is achieved. Only 4 μamp electron current is needed to produce the same ion current obtained from 8 mamp emission in a conventional Bayard-Alpert gauge. X-ray and photocurrents are held to low values by locating the ion collector remotely from the main source of light and x rays. The ion current is linear with pressure below 1×10^{-5} torr and has been tested down to 5×10^{-11} torr. (auth)

25758 PROBES FOR HIGH TEMPERATURE NUCLEAR MAGNETIC RESONANCE. Stefan Hafner and Norman H. Nachtrieb (Univ. of Chicago). Rev. Sci. Instr., 35: 680-2 (June 1964).

Two single-coil NMR probe and furnace assemblies are described for use with the Varian wide-line spectrometer at temperatures up to 750 and 1000°C, respectively. (D.C.W.)

25759 CESIUM VAPOR DISPENSER. A. L. Eichenbaum and M. E. Moi (RCA Labs., Princeton, N. J.). Rev. Sci. Instr., 35: 691-3(June 1964).

A simple dispenser of Cs vapor was investigated to determine its utility as a stable and controllable source of Cs vapor for long-life applications. The dispenser is basically a container filled with a mixture of Cs_2CrO_4 and Si powder. The powder reacts when it is heated to temperatures near 1000°K and releases a Cs vapor stream through a slit. The Cs vapor release rate was found to be stable and controllable by adjustments of the powder temperature. A constant and stable Cs flux could, therefore, be maintained over periods of many hours. At temperatures below 800°K, the powder mixture is inert. This permits conventional bakeout of the device and provides a convenient source of Cs vapor in demountable vacuum systems. (auth)

25760 ERRORS IN NOISE MEASUREMENTS DUE TO THE FINITE AMPLITUDE RANGE OF THE MEASURING INSTRUMENT. Charles Erwin Cohn (Argonne National Lab., Ill.). Rev. Sci. Instr., 35: 701-3(June 1964).

Systematic errors are introduced when amplitude measurements of Gaussian random noise are made with practical instruments having finite amplitude ranges. Graphs are presented for designing experiments to minimize these errors and for correcting existing data. (auth)

25761 THE MC 10 LEAK DETECTOR CELL: HELITEST 2002. J. L. Chatel and J. Moreau. Vide, 18: 580-4 (Nov.-Dec. 1963). (In French)

After the necessity of equipping leak detectors with low-pressure analytical cells is shown, the MC 10 analysis cell is described. Its principal characteristics such as sturdiness, simplicity, and interchangeability of constituent elements are then discussed. The performance, together with an indication of the principal control parameters, is given. (tr-auth)

25762 ELECTRON PARAMAGNETIC RESONANCE SPECTROGRAPH WITH FREQUENCY AND MAGNETIC FIELD MODULATION. Tai-chien Tung. Wu Li Hsueh Pao, 19: 816-23(1963).

A new electronic paramagnetic resonance spectrograph was developed in which greater stability and simplicity are achieved by combining frequency and magnetic field modulation. The spectrograph can be used to measure not only the narrow but also the broad bands, while being simpler than either the heterodyne or a-c Pose-Innes spectrographs. Because a magic T balance adjustment is used and a positive voltage is applied to the microwave crystal diode, the noise level is reduced almost to the level of thermal noise. A signal of 5×10^{-9} gram-moles DPPH could be observed on an oscillograph with a signal-to-noise ratio of 2:1 and an operation frequency of 9690 megacycles/sec. This observation proves the stability and sensitivity of the new spectrograph. (A.I.D. Press, Vol. 2, No. 237, June 1964)

25763 MEASUREMENTS OF KINETIC ENERGY OF FRAGMENT IONS USING MASS SPECTROMETERS. M. V. Gur'ev, L. V. Sumin, and N. N. Tunitskii (Karpov Research Inst. of Physics and Chemistry, Moscow). Zh. Tekhn. Fiz., 34: 536-45(Mar. 1964). (In Russian)

Energy and mean energy distribution functions for fragment ions were developed using the line shapes from a mass spectrometer. The convolution equation was used for the line analysis, and simple ratios connecting experimental data with the energy distribution, mean energy, and accumulation coefficient were obtained. The energy distribution of nitrogen ions was measured, and the effective cross section for their production by electron collision was estimated. (tr-auth)

25764 IMPROVEMENTS RELATING TO SPECTROMETERS. James Dyson (to Associated Electrical Industries Ltd.). British Patent 957,737. May 13, 1964. Filed June 9, 1961.

A spectrometer of the interferometric type is designed for measuring the broadening of a spectral line of a gas discharge when the gas is heated and thus determining the gas temperature. The spectrometer comprises a beam splitter, a plurality of interferometers for dividing each beam into four pairs of interfering beams and for recombining the pairs to form four interference patterns, and means for measuring the instantaneous intensity of each pattern. The principles of the operation of the spectrometer are discussed. (D.L.C.)

25765 THERMOCOUPLES. Grahame William Williamson (to United Kingdom Atomic Energy Authority). British Patent 958,159. May 13, 1964. Filed Apr. 9, 1962.

A process is given for preparing a sheathed insulated thermocouple junction at one end of a fine thermocouple cable. The process comprises the steps of baring the leads at one end, cropping the leads within the sheath, welding the cropped leads, packing insulant around the junction, ramming a plug into the open end of the sheath to compact the insulant, and arc welding the plug to the sheath. (D.L.C.)

25766 IMPROVEMENTS IN AND RELATING TO THERMOCOUPLE ARRANGEMENTS FOR NUCLEAR REACTOR FUEL ELEMENTS. George Michael Emsley and John Albert Robinson (to Nuclear Power Plant Co. Ltd. and AEI-John Thompson Nuclear Energy Co. Ltd.). British Patent 958,169. May 13, 1964. Filed July 3, 1962.

A thermocouple arrangement for measuring fuel element temperatures, is designed which includes a weak link device for the breaking of the thermocouple at the desired position when a fuel element is being removed. In the weak link device, the sheath is removed from the conductors for a portion of their length, and the sheath on one side of the bared portion is housed in a casing in such a manner that it can be moved only by a force smaller than that required to break the sheath but greater than that required to break the conductors. (D.L.C.)

25767 IMPROVEMENTS IN OR RELATING TO PULSE AMPLITUDE DISCRIMINATORS. Kathirkamathamby Kandiah (to United Kingdom Atomic Energy Authority). British Patent 959,696. June 3, 1964. Filed Apr. 21, 1961.

A current pulse amplitude discriminator is designed which is particularly suitable for use with a transistor output stage or with current pulses from photomultipliers or other transducers. The discriminator uses semiconductor elements as the active and nonlinear components. It ignores the d-c level of the input current, and its threshold is practically independent of the shape of the current pulse. After being triggered, it behaves like an a-c coupled trigger circuit. (D.L.C.)

25768 X-RAY ANALYSIS WITH A SOURCE OF BETA RAYS. Georges Seibel (Commissariat á l'Energie Atomique). British Patent 960,373. June 10, 1964. Priority date Sept. 15, 1959, France.

An improvement is presented of the process and apparatus described in British Patent 816,062, for determining the thickness of a deposit of an element or the concentration of an element in a sample by measuring the intensity of an x-ray characteristic of the element. The process comprises irradiating the sample with a low-energy beta beam from a radioisotope, spectro-analyzing the resulting x rays by means of a diffracting crystal, and measuring the diffracted x rays. An apparatus for carrying out the process is described. (D.L.C.)

25769 BETA RADIATION BACKSCATTER GAUGE. Vernon L. Eggebraaten, Harry D. Romo, and Kenneth Bendschneider (to Boeing Co.). U. S. Patent 3,132,248. May 5, 1964. Filed Nov. 20, 1961.

Equipment for measuring the thickness of very thin films by means of the beta radiation backscatter technique is described. A Geiger-Mueller counter is employed. (C.E.S.)

25770 GAS CHROMATOGRAPHY WITH MEANS TO FLOW IONIZATION PARTICLES INTO THE IONIZATION CHAMBER. Maurice R. Burnell, Yorba Linda, Richard A. Foster, and William S. Gallaway (to Beckman Instruments, Inc.). U. S. Patent 3,134,898. May 26, 1964. Filed June 27, 1960.

An ionization detector is designed which is simple, accurate, and does not require radioactive materials. The detector comprises a housing including an electron-generating zone and an ionization chamber with a flow

path therebetween, a first gas inlet for directing a stream of rare gas into the electron-generating zone, a gas outlet from the chamber, and a second gas inlet for directing the stream of sample gas into the chamber to mix with the stream of rare gas carrying electrons. (D.L.C.)

25771 INTENSITY MEASURING AND/OR RECORDING DEVICES FOR CORPUSCULAR RADIATION APPARATUS, PARTICULARLY ELECTRON MICROSCOPES. Ernst Guyenot and Eberhard Hahn (to VEB Carl Zeiss Jena). U. S. Patent 3,134,899. May 26, 1964. Filed Nov. 13, 1961.

A method and a device for measuring and indicating the current density of the final projection screen, are described for use as an exposure meter for electron microscopes. The method is based on increasing the beam deflection by part or all of the lens system and adjusting a compensation circuit to keep the image position on the final projection screen unchanged. (D.L.C.)

25772 SELECTING MASS SPECTROMETER HAVING SUBSTANTIALLY DOUBLED RESOLVING POWER. Karoly Andras, Andras Dallos, Janos Erdelyi, and Sandor Toth (to Tavkozlesi Kutato Intezet). U. S. Patent 3,136,888. June 9, 1964. Priority date Apr. 7, 1961, Hungary.

A selecting mass spectrometer is designed in which the Aston and Busch principles are combined to obtain a doubled resolving power and the elimination of errors due to energy spread of the ion source. In the spectrometer, the ions are caused to follow a helical path, and the ion collectors are spaced angularly around a circle concentric with the circular path. (D.L.C.)

25773 DENSITY DETERMINING APPARATUS COMPRISING RADIOACTIVE SOURCE AND DETECTOR. Robert R. Willet and Larry F. Hansen (to Nucleonic Controls Corp.). U. S. Patent 3,136,892. June 9, 1964. Filed Jan. 30, 1961.

A radiometric densitometer is designed for detecting and locating defective areas in nonmetallic materials, such as in the field testing of standing wooden power line poles for possible rot areas. The densitometer uses rays projected through the pole in an intermittent manner, and adjustments are made for compensation of the different variables involved. The operation of the densitometer is described in detail. (D.L.C.)

25774 TUNNEL DIODE DISCRIMINATOR CIRCUIT. Quentin A. Kerns (to U. S. Atomic Energy Commission). U. S. Patent 3,136,902. June 9, 1964.

An electronic circuit is designed for discriminating against electrical pulse signals having less than a selected minimum amplitude. For pulses exceeding the minimum amplitude by any of a wide range of values, the circuit provides output pulses of uniform amplitude. A tunnel diode biased at a voltage below the negative resistance region is connected in one leg of a bridge and has an essentially constant resistance in such condition which is balanced by a resistance in another leg of the bridge. If an input pulse has sufficient amplitude, the diode is driven into the negative resistance condition, whereupon the bridge is unbalanced and an output signal is obtained. (AEC)

25775 RADIOACTIVE GROUND DENSITY METER. V. A. Emelyanov. Russian Patent 160,024.

A radioactive ground-density meter containing a protective capsule with a tube closed at one end and pointed for insertion into the ground being tested is described. It contains a retractable radioactive preparation mechanically connected to a radiator. Measurement accuracy is increased by enclosing the capsule, together with a part of the tube, in a calibrated inspection vessel filled with liquid. (OTS)

Radiation Detection

Refer also to abstracts 25890 and 26166.

25776 (AEEW-M-381) A CONSIDERATION OF THE METALS WHICH CAN BE USED FOR THE CONSTRUCTION OF A WIDE RANGE IONISATION CHAMBER. A. Goodings (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Oct. 1963. 10p.

Metallic elements with melting points exceeding that of aluminum (658°C) are surveyed for possible use in the construction of ionization chambers for power reactors (in-pile). The metals are compared on the basis of neutron-activation characteristics, and it is concluded that titanium could be used for electrodes and casing. (R.E.U.)

25777 (AEEW-M-395) THE SATURATION CHARACTERISTICS OF HELIUM IN A D.C. FISSION CHAMBER. A. Goodings (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Oct. 1963. 12p. (JNPC/NFISG/P8)

The saturation characteristics of helium in d-c ionization chambers of typical geometry were investigated. (R.E.U.)

25778 (BNL-8083) BUBBLE CHAMBERS. Bibliography. Marjorie Comstock (Brookhaven National Lab., Upton, N. Y.). May 28, 1964. Contract AT-30-2-GEN-16. 57p.

References relating to bubble chambers, their components and applications, are arranged in chronological order from 1950 to date. 429 articles are cited; data analysis for bubble chambers is excluded. An author index is given. (R.E.U.)

25779 (CONF-182-15) WIRE CHAMBER—COMPUTER SYSTEM. J. Bounin, R. Miller, M. Neumann, J. Sarma, and H. Sherrard (Chicago. Univ.). [1963]. Contract AT(11-1)-636. 9p.

From 9th Scintillation and Semiconductor Counter Symposium, Washington, D. C., Feb. 1964

A wire-chamber with ferrite-core memory for receiving digitized spark information is described. On-line operation between the spark chamber and computer is advocated. (R.E.U.)

25780 (GEAP-4604) APPLICATION OF COUNTING TECHNIQUES TO IN-CORE ION CHAMBERS. Quarterly Progress Report, January–March 1964. R. A. DuBridge (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Apr. 1964. Contract AT(04-3)-189. 21p.

The design of a fission-chamber neutron detector for in-pile uses is presented. The counting system consists of a triaxial fission chamber and cable assembly; a low-input-impedance, fully transistorized voltage-pulse amplifier; and a 400-channel pulse-height analyzer. The chamber uses fully enriched U_3O_8, and operates at 500 v. (T.F.H.)

25781 (NAS-NRC-Pub-1184) INSTRUMENTATION TECHNIQUES IN NUCLEAR PULSE ANALYSIS. Proceedings of a Conference Held at The U. S. Naval Postgraduate School, Monterey, California, April 20–May 3, 1963. Nu-

clear Science Series Report Number 40. (National Research Council. Committee on Nuclear Science). 1964. 354p.

Separate abstracts were prepared for 57 of the 62 papers given; one was previously included in NSA, 17: 25540, and three are presented in abstract form only in the publication. (R.E.U.)

For abstracts of individual papers see: 25742, 25743, 25744, 25745, 25746, 25747, 25748, 25782, 25783, 25784, 25785, 25786, 25787, 25788, 25789, 25790, 25791, 25792, 25793, 25794, 25795, 25796, 25797, 25798, 25799, 25800, 25801, 25802, 25803, 25804, 25805, 25806, 25807, 25808, 25809, 25810, 25811, 25812, 25813, 25814, 25815, 25816, 25817, 25818, 25819, 25820, 25821, 25822, 25823, 25824, 25825, 25826, 25827, 25880, 25881, 25882, and 25883.

25782 (NAS-NRC-Pub-1184(p.15-17)) PULSE ANALYSIS AT HARWELL. E. H. Cooke-Yarborough (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

Pulse analyzing systems in use at Harwell are reviewed. (R.E.U.)

25783 (NAS-NRC-Pub-1184(p.18-22)) PULSE ANALYZERS IN CERN. H. I. Pizer (European Organization for Nuclear Research, Geneva).

Pulse analyzing systems at CERN are reviewed. (R.E.U.)

25784 (NAS-NRC-Pub-1184(p.42-5)) A POSITION-SENSITIVE SOLID STATE DETECTOR. E. Norbeck and R. C. Carlson (Iowa. State Univ., Iowa City).

A silicon junction solid state detector is described that has means for indicating not only the energy of a charged particle but the position of impact on the detector in one dimension. The detector has two wires on either end, between which the signal from a charged particle is divided; a third wire carries the total signal and therefore measures the total energy. Isometric display allows analysis of charged particles detected. (R.E.U.)

25785 (NAS-NRC-Pub-1184(p.46-7)) A SIMPLE TRULY ADIABATIC LIGHT PIPE FOR IMPROVED LIGHT COLLECTION AND TIMING. P. A. Piroue' (Princeton Univ., N. J.).

A lucite light pipe that presents a cross section of constant area and slowly varying shape to the photocathode of a photomultiplier tube is described. Special machining is not required as the pipe is composed of deformed strips of lucite. (R.E.U.)

25786 (NAS-NRC-Pub-1184(p.49-52)) ON THE CURRENT PULSES RELEASED BY SILICON SURFACE BARRIER DETECTORS. G. Fabri, E. Gatti, and V. Svelto (Milan. Politecnico. Istituto di Fisica).

The output pulses of several semiconductor detectors excited by alpha particles were observed to determine the total amount of released charge and the pulse waveform. Temperature and reverse voltage effects on the amplitude and waveform of the output pulse were studied. (R.E.U.)

25787 (NAS-NRC-Pub-1184(p.53-8)) TIMING WITH SEMICONDUCTOR DETECTORS. C. Cottini, E. Gatti, and V. Svelto (Milan. Politecnico. Istituto di Fisica).

The current output pulse of a semiconductor detector was calculated to evaluate the resolution limits in timing. Trapping effects were neglected and the mobility of charge carriers was assumed constant. (R.E.U.)

25788 (NAS-NRC-Pub-1184(p.59-60)) SOME ASPECTS OF TIMING USING SEMICONDUCTOR DETECTORS. F. S. Goulding (California. Univ., Berkeley. Lawrence Radiation Lab.).

Two extremes of collection times in semiconductor detectors and a rise-time phenomena observed in surface-barrier detectors, which limit their usefulness, are reported. (R.E.U.)

25789 (NAS-NRC-Pub-1184(p.61-4)) A LOW-NOISE PRE-AMPLIFIER FOR USE WITH SEMICONDUCTOR DETECTORS. F. S. Goulding and D. Landis (California. Univ., Berkeley. Lawrence Radiation Lab.).

A preamplifier was constructed for specific use with semiconductor detectors; the front-end stage can be easily removed and replaced according to the application. A field-effect transistor front-end is included. (R.E.U.)

25790 (NAS-NRC-Pub-1184(p.65-9)) LOW-NOISE PULSE AMPLIFIERS. K. Kandiah (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

The design of a charge-sensitive low-noise pulse amplifier with sufficient versatility for use with gas-filled ionization chambers as well as semiconductor detectors was studied. The performance of some valves under floating grid conditions was investigated by measuring the noise minimum point as the amplifier time constant was varied; the E810F was found most favorable. A field-effect transistor input element was investigated. (R.E.U.)

25791 (NAS-NRC-Pub-1184(p.70-8)) FIELD-EFFECT TRANSISTORS IN CHARGE-SENSITIVE AMPLIFIERS. V. Radeka (Brookhaven National Lab., Upton, N. Y.).

Field-effect transistors are investigated as low-noise active devices for charge-sensitive amplifiers. Noise sources, signal-to-noise relations, and charge-sensitive amplifier circuits for field-effect transistors are considered. (auth)

25792 (NAS-NRC-Pub-1184(p.79-88)) TRANSISTORIZED CIRCUIT MODULES FOR PULSE-HEIGHT ANALYSIS. A. F. Arbel (Israel Inst. of Tech., [Haifa]).

The development and design considerations of current-operated amplifier modules for pulse-height analyzers are discussed. Circuit stability and sensitivity are considered. (R.E.U.)

25793 (NAS-NRC-Pub-1184(p.89-95)) FAST TRANSISTORIZED AMPLIFIER WITH LARGE DYNAMIC RANGE. A. Alberigi-Quaranta and M. Martini (Bologna. Università. Istituto di Fisica "A. Righi.").

Design criteria for transistorized linear amplifiers exhibiting small rise-time (5 ns), good frequency overloading, good linearity, gain of 10, stability against ambient temperature changes, output on coaxial cable, input impedance of 1,000 ohms, and large dynamic range are discussed. (R.E.U.)

25794 (NAS-NRC-Pub-1184(p.96-103)) THE IDENTIFICATION OF CHARGED PARTICLES WITH A SOLID-STATE DETECTOR. T. K. Alexander and G. C. Neilson (Alberta. Univ., Edmonton).

The circuitry associated with solid-state detectors used to measure simultaneously, a particles' energy and time-of-flight, which can be fed to a fast analog circuit to deter-

mine the particles' mass, is described. A pulsed 1.4-Mev proton beam was used to investigate the technique. A zero-time signal was obtained by detecting the nanosecond beam pulses striking the target. (R.E.U.)

25795 (NAS-NRC-Pub-1184(p.112-16)) THE USE OF TIME DISCRIMINATION IN PULSE-HEIGHT ANALYSIS. T. L. Emmer (Radiation Instrument Development Lab., Inc., Oak Ridge, Tenn.).

Applications of Antiwalk discriminators are discussed. The variable pulse amplitude discriminator output pulse always occurs at the crossover of a double, delay-line shaped input pulse independent of the discriminator level. Improved time resolution may be achieved over a leading edge discriminator. (R.E.U.)

25796 (NAS-NRC-Pub-1184(p.117-18)) EVENT TIMING. K. Kandiah (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

The change-over from PNP to NPN transistors for a synchronized discriminator for zero crossing is reported. The original discriminator is described in NSA, 17: 14677. (R.E.U.)

25797 (NAS-NRC-Pub-1184(p.119-20)) LINEAR GATE AND BIASED AMPLIFIER. K. Kandiah (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

Gating circuits using transistors as saturated switches and effectively biased off into the nonconducting region are discussed. The use of symmetric transistors with high gain is discussed. (R.E.U.)

25798 (NAS-NRC-Pub-1184(p.121-3)) THE SERIES-PARALLEL TRANSISTOR SWITCH AS A LINEAR GATE. F. S. Goulding (California Univ., Berkeley. Lawrence Radiation Lab.).

The use of saturated transistor switches to overcome the nonlinearity in diode gate circuits for signals as large as 0.25 v in transistor amplifiers is discussed. (R.E.U.)

25799 (NAS-NRC-Pub-1184(p.124-34)) LINEAR AMPLIFIER, GATING AND TIMING SYSTEM. F. S. Goulding and D. Landis (California. Univ., Berkeley. Lawrence Radiation Lab.).

The design of gating and timing systems for linear amplifiers is discussed. Fast amplifying channels and coincidence circuits are used to permit short coincidence resolving times, and show amplifiers and gates for amplitude measurements. Pulse zero-crossing techniques are used. (R.E.U.)

25800 (NAS-NRC-Pub-1184(p.136-9)) ANALOGUE PULSE ARITHMETIC BY USE OF LOGARITHMIC P-N JUNCTIONS. E. H. Cooke-Yarborough (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

The reduction of errors in pulse-height information processing using logarithmic transistor emitters is discussed. (R.E.U.)

25801 (NAS-NRC-Pub-1184(p.140-2)) A PULSE MULTIPLIER USING LOGARITHMIC DIODES. R. C. Kaifer (California. Univ., Livermore. Lawrence Radiation Lab.).

The use of multiplying circuits using logarithmic diodes for E · dE/dX identification of charged particles is discussed. The log circuit contains high conductance fast diodes and simple transistor amplifiers with input and output impedances of less than one ohm. (R.E.U.)

25802 (NAS-NRC-Pub-1184(p.143-5)) PHOTOTUBE NOISE REJECTION AND OTHER PULSE-SHAPE DISCRIMINATION SYSTEMS USING A PULSE CROSS-OVER TECHNIQUE. D. Landis and F. S. Goulding (California. Univ., Berkeley. Lawrence Radiation Lab.).

It is pointed out that a standard amplifier and gating system can be used in a pulse zero cross-over mode as discriminator systems. Its use is illustrated in rejecting phototube noise when observing low-energy x-ray induced scintillations in NaI(Tl). (R.E.U.)

25803 (NAS-NRC-Pub-1184(p.146-9)) NEUTRON TIME-OF-FLIGHT ZERO CROSS-OVER PULSE SHAPE DISCRIMINATOR. R. W. Peelle and T. A. Love (Oak Ridge National Lab., Tenn.).

The development of a zero-crossing pulse-shape discriminator for use with NE 213 organic scintillator is reported. Its performance is shown for $D(d,n)^3He$, $T(d,n)^4He$, and a mixed source of gamma rays and neutrons. (R.E.U.)

25804 (NAS-NRC-Pub-1184(p.150-64)) DIGITAL STABILIZING METHODS FOR MULTI-CHANNEL ANALYSING SYSTEMS. J. A. Ladd and J. M. Kennedy (Atomic Energy of Canada Ltd., Chalk River, Ont.).

Two methods of spectrum stabilization are discussed. "On-line" digital stabilization and post-experimental computer stabilization are exhibited. Plots are given for the spectra of ^{60}Co, ^{241}Am, and ^{137}Cs. (R.E.U.)

25805 (NAS-NRC-Pub-1184(p.165-8)) ON A MULTICHANNEL TRANSISTORIZED PULSE-HEIGHT ANALYZER. A. Alberigi-Quaranta and B. Righini (Bologna. Università. Istituto di Fisica "A. Righi.").

The development of a fast pulse-height multichannel (16 channels) analyzer with an overall dead-time of the order of 1 μsec for use in high-energy physics is discussed. Some characteristics of the analyzer are discussed. (R.E.U.)

25806 (NAS-NRC-Pub-1184(p.169-71)) A POSSIBLE METHOD OF IMPROVING THE LOW-LEVEL LINEARITY OF PULSE-HEIGHT-TO-TIME CONVERTERS. E. H. Cooke-Yarborough (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

A circuit that avoids the effects of the curvature of the nonlinear circuits that charge the storage capacitor of pulse-height-to-time converters by adding a pulse of constant amplitude to each input pulse is described. (R.E.U.)

25807 (NAS-NRC-Pub-1184(p.172-6)) A FAST BINARY ANALOG-TO-DIGITAL CONVERTER. K. Franz and J. Schulz (Telefunken G.m.b.H., Ulm, Germany).

A 256-channel analog-to-digital converter is described that evaluates pulse height through binary weighting. Integral and differential linearity is better than 1%. Dead time is smaller than 10 μsec and independent of pulse height. (auth)

25808 (NAS-NRC-Pub-1184(p.177-9)) THE PERFORMANCE OF AN ANALOGUE-TO-DIGITAL CONVERTER OF RECENT DESIGN. K. Kandiah (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

The limitations of the overall analyzing system attributable to a converter, which uses a feed-back system for pulse stretching and a staircase generator and comparison system of high stability, were investigated. The parameters of a spectrum stabilizer were determined. (R.E.U.)

25809 (NAS-NRC-Pub-1184(p.180-3)) AN ANALOG-TO-DIGITAL CONVERTER USING A COMPARATOR TECHNIQUE. J. Leng (Atomic Energy of Canada Ltd. Chalk River Nuclear Labs., Chalk River, Ont.) and P. K. Patwardhan (India. Atomic Energy Establishment, Trombay).

An analog-to-digital converter encoder logic using a two-step count down is described. Poor differential linearity resulting from previous uses of the system is reduced using addition by ladder networks rather than switching of high-level bits. (R.E.U.)

25810 (NAS-NRC-Pub-1184(p.184-5)) A FAST PULSE HEIGHT ANALYZER. J. B. Lindsay (European Organization for Nuclear Research, Geneva).

The use of the CERN 25 mc scaler system for storage and read-out for a fast (dead time <1 μsec) pulse-height analyzer is discussed. The height-to-time converter developed for use with the system is also discussed. (R.E.U.)

25811 (NAS-NRC-Pub-1184(p.186-94)) CONSIDERATIONS ON SOME CAUSES OF INACCURACY IN THE ANALOG-TO-DIGITAL CONVERSION. P. F. Manfredi and A. Rimini.

Some causes of nonlinearities in Wilkinson-type amplitude-to-time converters are discussed. Several converter schemes are analyzed. (R.E.U.)

25812 (NAS-NRC-Pub-1184(p.204-6)) APPLICATIONS OF FIELD EFFECT TRANSISTORS IN LOW-NOISE WIDEBAND VOLTAGE AND CHARGE-SENSITIVE PREAMPLIFIERS. T. V. Blalock and J. F. Pierce (Oak Ridge National Lab., Tenn.).

Several preamplifier circuit configurations using field-effect transistors in the input stage are investigated. (R.E.U.)

25813 (NAS-NRC-Pub-1184(p.207-9)) POSSIBLE USE OF PULSE ANALYSERS FOR MEASUREMENT OF TRANSFER FUNCTIONS BY CROSS-CORRELATION. E. H. Cooke-Yarborough (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

The application of pseudorandom digital codes to the determination of the transfer function of a reactor is discussed. A forcing signal in the form of a control rod movement is applied and a response in the form of pulse rate of the pulse counter in the reactor is obtained. A large number of gated scalers is used to perform the cross-correlation; all are connected through their gates to the radiation detector. (R.E.U.)

25814 (NAS-NRC-Pub-1184(p.210-11)) STANDARDIZATION. M. Graham (Rice Inst., Houston, Tex.).

Compatibility among modular instrumentation systems is discussed. Some design standards are suggested. (R.E.U.)

25815 (NAS-NRC-Pub-1184(p.212-15)) THE USE OF AVALANCHE DIODES TO PRODUCE RANDOM PULSES. K. Kandiah (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

The performance of avalanche diodes in producing random pulses used in testing multichannel analyzers is discussed. (R.E.U.)

25816 (NAS-NRC-Pub-1184(p.216-19)) A "RAMP-PULSER" FOR TESTING LINEARITY OF PULSE-ANALYSIS SYSTEMS. L. B. Robinson (California. Univ., Berkeley. Lawrence Radiation Lab.).

A time-wise linear electronic sweep generator was constructed, which has its output voltage sampled by a chopper circuit that produces practically no amplitude-dependent error, to test pulse-height analyzers. (R.E.U.)

25817 (NAS-NRC-Pub-1184(p.220-8)) CONSTANT AMPLITUDE LIGHT FLASH GENERATOR FOR GAIN STABILIZATION OF PHOTOSENSITIVE SYSTEMS. Q. A. Kerns and R. F. Tusting (California. Univ., Berkeley. Lawrence Radiation Lab.).

A constant-amplitude light flash generator used to stabilize photosensitive systems such as photomultiplier tubes is described. The generator was used to check the gain of a photomultiplier during the interval between beam bursts of a cyclotron. The light comes from a small d-c "keep-alive" current flowing at all times in an argon glow lamp. (R.E.U.)

25818 (NAS-NRC-Pub-1184(p.229-36)) AN ULTRA HIGH-SPEED ANALYZER-COMPUTER. R. D. Carlson, G. F. Comiskey, and R. A. Karlin (Linear, Inc., Wilmette, Ill.).

A pulse-height analyzer with dead-time of 1 μsec, scaling rate of 20 mc, and an address advance time, in scaling mode, of less than 1 μsec was investigated. Memory devices with 30 to 40 words and a capacity of about 10^5 per word were investigated. The internal converter, sequential access, random access, and random access count one modes of operation were studied. A Wilkinson-type converter utilizing a 100 mc oscillator and a trial-type encoder were studied for use with the fast memory composed of tunnel diodes on thin film. (R.E.U.)

25819 (NAS-NRC-Pub-1184(p.237-8)) FLEXIBILITY OF A STANDARD PULSE-HEIGHT ANALYZER FOR MULTIPARAMETER EXPERIMENTS. Umberto Pellegrini (Milan. Università).

Modifications in a standard pulse-height analyzer to provide for multiparameter experiments are reported. The information from each event is expressed in binary form and stored in a memory register containing 16 bits. The register transfers the binary information to one channel of the analyzer, therefore there is a memory capacity of only 512 events for a 512-channel analyzer. (R.E.U.)

25820 (NAS-NRC-Pub-1184(p.239-46)) MULTIPARAMETER ANALYSIS SYSTEM FOR DATA COLLECTION AND PROCESSING. Y. Amram (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay).

Requirements for multiparameter analyzing systems are reviewed. A time-of-flight encoder (2^{16} channels) with 50-nsec minimum channel width, fast amplitude-to-time converter, one-word buffer and sequencing unit, derandomizing store, magnetic tape unit, and condition unit are described. The use of a computer on-line was studied. (R.E.U.)

25821 (NAS-NRC-Pub-1184(p.255-65)) A NUCLEAR RADIATION RECORDER ANALYZER. E. B. Brown, E. A. Gere, and J. V. Kane (Bell Telephone Labs., Inc., Murray Hill, N. J.).

A nuclear radiation recorder analyzer was constructed based on a stored program computer. The hardware incorporates an input system containing two analog-to-digital converters, a fast-slow coincidence circuit, a scaler, a logic system for both multiplex counter operation and computer-controlled singles/coincidence mode operation of the analog-to-digital converters. Provision exists for additional converters. A cathode-ray tube out-

put system was built incorporating a memory location oriented display scope with wired range switch, an x–y point plotting scope, and a light pen cathode-ray tube input. The design philosophy was to attempt to link a highly flexible counter system to a fast, efficient, and flexible display system through a stored program computer employing magnetic core and magnetic tape as essential memory elements. An SDS 910 Stored Program Digital Computer is used as the central processing unit. (auth)

25822 (NAS-NRC-Pub-1184(p.283-6)) THE IOWA FOUR-PARAMETER ANALYZER. E. Norbeck and R. R. Carlson (Iowa. State Univ., Iowa City).

A four-parameter pulse-height analysis system was assembled from commercial components; four 1024-channel analog-to-digital converters, a CDC-160A computer, two magnetic tape units, an oscilloscope, an off-line typewriter, and an off-line printer capable of 32,000 channels of pulse data per minute. The construction and operation of the system are considered along with operational philosophy of multichannel analysis. (auth)

25823 (NAS-NRC-Pub-1184(p.287-91)) A MULTIPARAMETER PULSE-HEIGHT RECORDING SYSTEM. M. Nakamura and G. S. Simonof (California. Univ., Berkeley. Lawrence Radiation Lab.).

The multiparameter pulse-height recording system at Berkeley (LRL) is described. The system can record up to 10 coincident parameters for each event. The magnetic recording system is described and compatibility with IBM 7090 is discussed. (R.E.U.)

25824 (NAS-NRC-Pub-1184(p.305-12)) MULTIDIMENSIONAL KICKSORTER USING MAGNETIC-TAPE STORAGE. T. K. Alexander and R. A. McNaught (Alberta. Univ., Edmonton).

A magnetic-core analyzer used in conjunction with a large-capacity magnetic tape system for multiparameter sorting is described. The 900-channel pulse analyzer was put into operation at Chalk River in 1961 and, because of its modular nature, has been in operation ever since with many improvements. The encoder, storage unit, and display and control unit are described. (R.E.U.)

25825 (NAS-NRC-Pub-1184(p.313-19)) A LIGHT PROBE DIGITAL INTERROGATOR FOR ANALYZER OSCILLOSCOPE DISPLAYS. R. L. Heath (Phillips Petroleum Co., Idaho Falls, Idaho).

A system is described for retrieval of digital information from a given dot on an oscilloscope display instantaneously. A light probe in the form of a pencil is used to identify visually the channel in question. (R.E.U.)

25826 (NAS-NRC-Pub-1184(p.322-3)) DISPLAY SYSTEM FOR MULTIPARAMETER EXPERIMENTS. K. Kandiah (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

A storage tube is proposed to function in accumulation, read-out, and display for multiparameter pulse experiments. (R.E.U.)

25827 (NAS-NRC-Pub-1184(p.325-30)) DEVELOPMENT OF "NANOBOXES." D. Maeder (Geneva. Université).

Research on "circuits logiques rapides" in the University of Geneva Experimental Nuclear Physics Lab is reviewed. The design specifications are discussed. The so-called nanoboxes will be used in triggering circuits for spark chambers. (R.E.U.)

25828 (TID-20646) A SPARK CHAMBER PULSER FOR AIR-BORNE USE. Robert E. Daniels and Arthur D. Cook (Argonne National Lab., Ill.). Jan. 13, 1964. Contract [W-31-109-eng-38]. 11p.

Design considerations for a spark chamber pulser for use in the air-borne e^{s}. Experiment at Argonne are discussed; reliability, light weight, and high electrical efficiency in addition to normal requirements are considered. A cold-cathode kryptron gas tube was selected: E. G. and G. specifications are given. (R.E.U.)

25829 (AEC-tr-6372(p.29-34)) BETA DOSE MEASUREMENTS WITH A COMPENSATED CALORIMETER. Yota Nakai, Harumi Izura, Koji Matsuda, Shigehiro Osuga, and Kiichi Kimura. (Translation)

The results of studies on calorimeters indicate that a carefully constructed compensated calorimeter makes possible beta input energy measurements of relatively good precision with relative ease. However, it is stressed that there are many technological problems to be overcome in order to fabricate an instrument for absolute measurements. (P.C.H.)

25830 (AEC-tr-6372(p.35-47)) MEASUREMENT OF BETA CURRENT DENSITY WITH A FARADAY CHAMBER. Yota Nakai, Harumi Izura, Koji Matsuda, Shigehiro Osuga, and Kiichi Kimura. (Translation)

The method and equipment are described for measuring beta current density using a Faraday chamber. Problems associated with the Faraday chamber are discussed. The current density was estimated to be 0.850 $\mu a/cm^2$. (P.C.H.)

25831 INVESTIGATION OF FLUCTUATION AND IONIZATION IN PROPORTIONAL LOW-PRESSURE DETECTORS. E. O. Agasyan and G. A. Marikyan. Izv. Akad. Nauk Arm. SSR, Ser. Fiz.-Mat. Nauk, 16: 125-30 (1963). (In Russian)

The spread of ionization fluctuations was studied as a function of filling gas mixture in proportional counters. Correlations of experimental and theoretical ionization curves resulted in more exact criteria for selecting layer thicknesses for cascade measurements. A G-M telescope with two proportional counters and radiometric apparatus was installed for measuring μ meson trajectories. A series of five coincidence and one anticoincidence G-M counters with 1350 g/cm^2 and 283 g/cm^2 absorbers between them were used for measuring two groups of μ mesons with momenta ($3 \leq p/\mu \leq 7$) and ($p/\mu > 7$). Argon (25%) and methane (75%) at 40 cm Hg pressure was used. The experimental curve spread was wider than the theoretical; half widths 48 ± 2.5 and 31%, respectively. The curve spread for μ mesons with $p/\mu \geq 7$ was 0.53%. Differential ionization fluctuation curves for μ mesons (3 to 7) p/μ in propane-filled counters had relative widths of (42 ± 3), (49 ± 2.5), and (65 ± 5)%. (R.V.J.)

25832 DESIGN OF NUCLEAR ELECTRONIC DEVICES WITH SPECIAL REGARD TO THEIR FUNCTION AND THE RESULTING CONSTRUCTION PRINCIPLES. M. Baba, A. Csakany, and F. Vajda (Central Research Inst. of Physics, Budapest). Kernenergie, 7: 218-26(Apr. 1964). (In German)

Problems in nuclear electronic measuring techniques are reviewed. The designs of nuclear electronic systems are discussed. Electric, mechanical, and other characteristics of the systems are described. Radiation detectors and all the associated equipment are shown in diagrams for different measuring arrangements. (M.C.G.)

25833 SILICON PHOTOCELLS FOR HIGH GAMMA-RAY DOSE RATE MEASUREMENTS. H. Ulrich (Institut fur Angewandte Physik der Reinststoffe, Dresden). Kernenergie, 7: 231-5(Apr. 1964). (In German)

Results are presented on the preparation and use of silicon photocells for dose-rate measurements on a ^{60}Co irradiation installation. The work curves, the temperature and direction dependence, as well as fatigue manifestations in some detectors were investigated. By using a sensitive galvanometer or a d-c amplifier the dose rates from 5 to 10^6 r/hr could be measured. Comparisons were made with analog detectors using n-germanium as the basic material. (tr-auth)

25834 PROPERTIES OF AN OVERALL SENSITIVE PROPORTIONAL COUNTER IN X-RAY FLUORESCENT ANALYSIS. D. Mueller (Institut fur Angewandte Radioaktivitat, Leipzig). Kernenergie, 7: 249-54(Apr. 1964). (In German)

A gas-flow proportional counter for spectrometric detection of x radiation, which is distinguished by simple construction as well as versatile applicability, is described. On account of the limited absorption of the x radiation in the relatively thin counter walls composed of low-atomic-weight material, an entrance window for the radiation could be relinquished. (tr-auth)

25835 A SYSTEM OF NUCLEAR MEASURING EQUIPMENTS. J. Bosch (Frieseke & Hoepfner GmbH, Erlangen, Ger.). Kerntechnik, 6: 155-8(Apr. 1964). (In German)

A system of equipment is described, which includes electronic instruments, radiation detectors, shielding, and sample changers. The electronic instruments are transistorized, the detectors include ionization chambers, proportional counters, G-M tubes, and scintillation counters. Shieldings and sample changers adapted to each other, are joined in a round and a rectangular system. Examples of the combination of different units are given. (auth)

25836 THE SEMICONDUCTOR DETECTOR, A NEW COUNTING DEVICE FOR NUCLEAR ENGINEERING. R. Staeudner (NUCLETRON, Munich). Kerntechnik, 6: 172-3(Apr. 1964). (In German)

The method of operation and characteristics of semiconductor detectors are described. (M.C.G.)

25837 SEMICONDUCTOR PARTICLE DETECTORS. PART 2. A. Hess and H. Schneider (Universität, Giessen, Ger.). Kerntechnik, 6: 183-5(Apr. 1964). (In German)

The various types of semiconductor-barrier layer detectors are described and compared. Uses of semiconductor dectors for spectroscopy of ionizing radiation, detection and spectroscopy of neutrons, and detection and spectroscopy of gamma and x radiation are discussed. (M.C.G.)

25838 MEASUREMENTS OF THE ABSOLUTE INTENSITY OF DIFFUSE ROENTGEN SMALL-ANGLE SCATTERING BY MECHANICAL WEAKENING OF THE PRIMARY BEAM THROUGH ADAPTATION OF THE IMPULSE-COUNTING TECHNIQUE. O. Kratky and H. Wawra (Universität, Graz). Monatsh. Chem., 94: 981-7(1963). (In German)

A new approach to x-ray small-angle analysis, determination of the ratio of scattered energy to primary beam, is introduced. In order to measure the intensity of the primary beam, it is necessary to reduce the intensity by several orders of magnitude. This is accomplished by a rotator; the apparatus described has four apertures that pass 32×10^3 times less light than the primary impinging beam. Sources of error and corrections are discussed; among these are the size of the aperture, coincidences of quanta, the rotation number of the disc interrupting the beam, and special techniques for determinations with counters of various types. Geiger-Mueller counters with filter difference monochromators require corrections; use of a proportional counter in combination with an impulse height discriminator set on a narrow band width requires corrections for coincidence, for example, of 2 K_α lines. Interpretation of the scattering curve may be used for quantitative reference in measurements. The relative positions of the rotator plane and the counter diaphragm also require care. A number of large molecules and proteins have been studied with this technique; these are listed with 11 references to recent literature. Special note is made of micellar systems. (BBB)

25839 USE OF GLASS FIBRE PAPER IN LIQUID SCINTILLATION COUNTING. D. M. Gill (Cambridge Univ., Eng.). Nature, 202: 626(May 9, 1964).

The efficiency of counting typical water-soluble radioactive compounds supported on various filters was determined on a liquid scintillation counter (coincidence counter with photomultiplier tubes either side of the counting bottles). Known amounts of ^{3}H- and ^{14}C-labeled amino acids were applied evenly to the filters. It was found that the efficiency of tritium counting is very much greater, and the efficiency of ^{14}C counting was slightly greater, using glass fiber paper than using cellulose paper. A further advantage of glass paper is that it holds about twice the volume of liquid as the same area of paper, enabling larger volumes of solution to be applied for drying. (P.C.H.)

25840 SATURATION CHARACTERISTICS OF PARALLEL-PLATE IONIZATION CHAMBERS. J. R. Greening (Edinburgh Univ.). Phys. Med. Biol., 9: 143-54(Apr. 1964).

Theories of volume recombination of ions between parallel electrodes are briefly reviewed and are compared with extensive published and unpublished experimental data for the case where air is the ionized gas. It is concluded that Mie's theory is true over the range tested (currents greater than 0.7 of saturation current), but that of Boag and Wilson is valid only very near to saturation. A simple expression is deduced from Mie's theory giving the efficiency of ion collection in terms of electrode separation, rate of ion production, polarizing voltage, recombination coefficient, and ion mobilities. The application of this expression to the determination of saturation currents and to the design of ionization chambers is discussed, and brief mention is made of losses due to diffusion and initial recombination. (auth)

25841 A DOUBLE-FOCUSING MAGNETIC SPECTROMETER FOR CHARGED PARTICLES FROM NUCLEAR REACTIONS. Trygve Holtebekk (Universitetet, Oslo). Phys. Norvegica, 1: 177-86(1963).

A 180°, double-focusing magnetic spectrometer for protons and alpha particles with energies below 6 Mev is described. The spectrometer has an acceptance solid angle of $(1.55 \pm 0.05) \times 10^{-2}$ steradians with a resolving power in momentum of about 1000. With some loss in resolving power the solid angle may be increased to $(1.87 \pm 0.06) \times 10^{-2}$ steradians, about twice that of any previously reported instrument of this type. A target chamber which allows rotation of the spectrometer from −140° to +140° without letting air into the vacuum system is also described. (auth)

25842 IONIZATION LOSS OF MUONS IN A PLASTIC SCINTILLATOR. A. Crispin (Northern Polytechnic, Lon-

don) and P. J. Hayman. Proc. Phys. Soc. (London), 83: 1051-8(June 1964).

The energy loss of cosmic muons was studied in an organic scintillation counter over the momentum range 0.4 to 100 Bev/c. The results are compatible with the Sternheimer density correction to the ionization loss theory of Bethe-Bloch up to 10–15 Bev/c, but they suggest that at higher momenta the most probable energy loss may be about 3% ± 1% above the predicted rise. The energy loss of positive and negative muons is found to be the same within 1%. The work described is based on 5089 particles, 810 having momentum not less than 20 Bev/c. (auth)

25843 DESIGN OF 4π COUNTER WITH MUTUAL ANTICOINCIDENCE. T. A. Brody and J. Calvillo. Rev. Mex. Fis., 12: 139-58(1963). (In Spanish)

A theoretical study of the mutual-anticoincidence principle (Alba 1959) by means of Monte Carlo methods gave comparative values for the reduction in background counts of 4π-counters with 2 anodes and various geometries and with 8 anodes. A cylindrical counter with 2 anodes gave experimental results that differ from theory because of changes in the sensitive volumes, but confirmed the usefulness of the mutual-anticoincidence principle. (auth)

25844 RADIODOSIMETRY BY CHEMICAL METHODS. Maria Do Carmo Anta (Laboratorio de Fisica e Engenharia Nucleares, Sacavem, Portugal). Rev. Port. Quim., 3: 85-100(June 1961). (In Portuguese)

The use of chemicals for the dosimetry of radiations is reviewed. The reasons for interest in chemical dosimetry are briefly reported. The methods for the precise measurement of doses above 1000 rads and below 1000 rads are reported. Tridimensional chemical dosimetry is also considered. 61 references. (J.S.R.)

25845 PLASTIC SCINTILLATOR RESPONSE TO 1-10 kev PHOTONS. A. J. Meyerott, P. C. Fisher, and D. T. Roethig (Lockheed Missiles and Space Co., Palo Alto, Calif.). Rev. Sci. Instr., 35: 669-72(June 1964).

The linearity and absolute detection efficiency of several different plastic scintillator-phototube combinations were determined for photon energies between 1 and 10 kev. Fluorescent x-ray techniques were used to provide monochromatic photon beams which were allowed to impinge on the scintillator or, alternately, on a proportional counter monitor. Indications were obtained of nonlinear photoelectron/photon response. Clearly nonlinear behavior was obtained for conversion efficiencies expressed as photoelectrons/kev of photon energy absorbed. (auth)

25846 RADIOISOTOPES IN SEMICONDUCTOR SCIENCE AND TECHNOLOGY. Werner Kern (Radio Corp. of America, Somerville, N. J.). Semicond. Prod., 6: No. 10, 22-5 (Oct. 1963).

The essential properties of radioactive isotopes are summarized, and some techniques for using radioisotopes in determining the distribution of trace quantities in columns and ingots, etching and rinsing transistors, and assessing the contamination of semiconductor surfaces are discussed, together with typical results obtained. (D.C.W.)

25847 THICK-WALLED IONIZATION CHAMBER FOR MONITORING γ RADIATION AT O < W < 100 Mev. A. K. Kaminskii and E. S. Lonskii. Zh. Tekhn. Fiz., 34: 527-9 (Mar. 1964). (In Russian)

Sensitivities of an aluminum chamber with front wall thicknesses of 5, 7.5, and 10 cm for γ quanta with energies of O < W < 50 Mev and a graphite chamber with front wall thicknesses of 8.35, 16.7, and 25 g/cm^2 for O < W < 100 Mev (the graphite front walls of 5, 10, and 15 cm of 1.67 g/cm^3 graphite) were calculated. Polarization effects on ionization losses in Al and C, the difference in electron and positron ionization losses, screening effects and coulomb corrections in effective cross sections for pair production and bremsstrahlung, differential effective cross sections of pair production as a function of electron energy, and the latest data on electron trajectories in Al and C and on ionization potential were considered, as well as effects of photonuclear reactions and the ratio of delayed reactions in the air to the delayed reactions in Al and C as a function of energy. (R.V.J.)

25848 SEMICONDUCTOR PARTICLE DETECTORS. J. M. Taylor. Semiconductor Monographs. Washington, [D. C.], Butterworths Inc., 1963. 192p. $8.25.

The relevant properties of semiconductors and barrier layers are reviewed; and the design, principles, performance, merits, and preparation of bulk semiconductor detectors, barrier detectors and P-I-N detectors are described. Electronic instrumentation, electrical noise, and some recent developments are also considered. Examples of applications and the results obtained are given. (D.C.W.)

25849 DEVELOPMENT OF A LIQUID HELIUM SCINTILLATOR. William Woodford Willis. Thesis, Charlottesville, Va., Univ. of Virginia, 1963. 44p.

The purpose of this research was to develop a practical and efficient liquid helium scintillator which could be used as a neutron polarimeter in the 10 to 20 Mev energy range. In neutron counting, the actual source of the scintillations in the liquid helium is not the incident neutron but the recoil alpha particle from an (n,α) elastic scattering event. In the research described, the scintillations in liquid helium under alpha particle bombardment from a ^{210}Po alpha source were studied under a variety of conditions including various optical and waveshifting arrangements in order to determine the factors influencing light output and pulse height resolution of a liquid helium scintillator. The liquid helium was contained in a concentric Thermos Brand glass dewar system; the outer dewar was filled with liquid nitrogen, the inner with liquid helium. Under normal operating conditions, liquid helium could be contained for about three hours, corresponding to a heat input to the system of about 0.2 watt. The scintillating volume was defined by a thin-walled Al can whose sides and bottom were coated with the waveshifter under study. The Al can was taped to a light pipe, either quartz or lucite, through which the scintillations passed into an RCA type 6903 phototube. The Al can and part of the light pipe remained under the liquid helium; the upper part of the light pipe was at room temperature. The pulses from the phototube were amplified by conventional means and were analyzed by a Penco PA-4 100-channel analyzer. Four waveshifters and three light pipes were studied. The waveshifters used were: p-quaterphenyl (PQ), p-p' diphenylstilbene (DPS), p-bis(2,5-phenyloxazolyl)benzene (POPOP), and sodium salicylate (SS). PQ and DPS gave pulse heights roughly half as high as POPOP and SS; the resolutions were also poorer. SS tends to wash off and contaminate the insides of the dewar, so POPOP was chosen as being the best waveshifter tried. The quartz light pipe gave no better results than the lucite, even though it transmits more uv light; this is due to the waveshifters emitting visible light, and the liquid helium scintillations themselves being extreme uv. A strong diverging lens was ground into the end of the lucite light pipe; the resolution improved only slightly. The best energy resolution, 32%, was obtained using POPOP as the waveshifter and the

lensed lucite light pipe. The behavior of the scintillator under neutron bombardment was studied. Monoenergetic recoil alphas from the scattering of the $T(d,n)He^4$ monoenergetic neutrons were selected by requiring a coincidence between the recoil alpha particles and the neutrons scattered through 123°. The recoil spectrum was spread more energetically than the resolution of the helium scintillator developed; this extra spread has been attributed to finite size of detectors, and unfavorable coincidence rates. (Dissertation Abstr.)

25850 NUCLEAR RADIATION DETECTION. William J. Price. Second Edition. McGraw-Hill Series in Nuclear Engineering. New York, McGraw-Hill Book Company, 1964. 438p. $12.75.

The principles, designs, applications, and statistics of radiation detectors are presented after a review of the properties of radiations. Neutron detection methods are treated separately, and the electronic apparatus of detection systems is considered. Ionization chambers, Geiger-Muller counters, proportional counters, scintillation detectors, semiconductor detectors, and emulsions are the main methods covered. (D.C.W.)

25851 THE REPRESENTATION OF THE MOTION OF γ-RADIATING MATTER IN INACCESSIBLE AREAS WITH A γ-RETINA. A. Scheidweiler. Thesis, Aachen, Technische Hochschule, 1963. 82p. $2.00(Gmelin, AED-DISS. 63-309). (In German)

A γ-retina with 100 scintillation counters, whose NaI(Tl) crystals are packed in a plane, is described. To obtain good spatial resolution, light guides are used between crystals and photomultipliers. The construction of a multichannel collimator is described. Information from the 100 counters is treated separately and then united into an optical image. Motion of γ-radiating matter can be observed directly on an oscilloscope. Velocities of 1 m/sec can be reproduced without time delay. (Gmelin Inst.)

25852 X-RAY SPECTROMETER, 10 INCH (Engineering Materials). (California. Univ., Berkeley. Lawrence Radiation Lab.). (CAPE-916)

The monochromatic bent crystal x-ray spectrometer is used in the analysis of L-series x rays produced in radioactive decay processes of transuranium elements. There is good agreement between the energy values of the L-series lines measured with the spectrometer and those predicted. (129 drawings) (C.E.S.)

25853 DETECTION, SEGREGATION AND COUNTING OF RADIATIONS OF DIFFERENT ENERGIES. Ralph C. Maggio and Charles Christianson. U. S. Patent 3,132,249. May 5, 1964. Filed Feb. 16, 1961.

A device for the detection of low-energy beta radiation is described. The device uses a radiation detector of the type in which ionization of a confined gas in an electric field by radiation produces counting pulses in a utilization circuit. (C.E.S.)

25854 NUCLEAR RADIATION GLOW TUBE INDICATOR AND CALIBRATION MEANS. James H. Wilde (to Small Business Administration). U. S. Patent 3,134,901. May 26, 1964. Filed Sept. 29, 1961.

A nuclear radiation indicator is designed which is light in weight and inexpensive to manufacture. The indicator comprises a radiation-electrical transducer having an output circuit including a first gas glow tube, a comparison circuit including a source of predetermined voltage and a second gas glow tube, a light wedge for controlling the light intensity of the second gas glow tube so as to match that of the first tube, and calibrated means for adjusting the light wedge. The indicator is housed in a casing with a window for matching the light intensities of the tubes. Alternatively, a variable resistor or frequency oscillator can be used in place of the light wedge to control the light intensity of the second tube. (D.L.C.)

25855 APPARATUS FOR DETERMINING GAMMA OR X-RAY DOSAGE. Winston B. Clarke and Robert J. Meltzer (to Bausch and Lomb Inc.). U. S. Patent 3,136,889. June 9, 1964. Filed Dec. 6, 1961.

An apparatus for gamma or x-ray dosimetry using a fluorescing body (e.g., a silver phosphate glass) is designed which separates predose fluorescence (background) from the postdose fluorescence (signal). The apparatus includes a uv source for exciting the body, a rotating mirror for modulating the uv beam at a high frequency, and means for measuring the decay rate of the excited fluorescence as a means of separating the predose and postdose fluorescences. (D.L.C.)

25856 IMPROVEMENTS RELATING TO THE DETECTION OF THE ESCAPE OF FISSION PRODUCTS. Innes Craig Hendry and John Griffiths (to United Kingdom Atomic Energy Authority). British Patent 960,226. June 10, 1964. Filed Feb. 2, 1961.

A method is given for detecting the escape of fission products from an irradiated sheathed fuel element into a fluid stream. The method comprises isolating a sample of the stream and measuring over a period of time the radiations with energy between 1.5 and 6 Mev in order to determine the decay rate. An apparatus is designed with a conduit system having valves which allow either a continuous stream to flow past the scintillation detector or a sample of the stream to be isolated with the detector. A beta-sensitive organic phosphor is used in the detector, and circuits are given for the automatic operation of the apparatus. The detector chamber may be lined with a synthetic resin for easy decontamination. (D.L.C.)

25857 PROCESS AND DEVICE FOR DETERMINING THE PROPORTION OF SIMULTANEOUSLY EMITTED NEUTRONS. Albert Gey and Jacques Jacquesson (to Commissariat á l'Energie Atomique). British Patent 960,548. June 10, 1964. Priority date Aug. 11, 1961, France.

A process is given for determining the number of neutrons emitted simultaneously from a neutron source. The process comprises detecting the neutrons by a detector which in response to two or more simultaneous neutrons produces a like number of output signals within a finite time interval T, counting the signals on a first counting circuit with a negligible dead time and on a second circuit with a dead time on the order of T, and comparing the counts. (D.L.C.)

25858 LINEAR SEMICONDUCTOR JUNCTION RADIATION DETECTOR. James W. Mayer, Stephen S. Friedland and John S. Wiggins (to Hughes Aircraft Co.). German Patent 1,162,494. Feb. 6, 1964. Priority date Jan. 25, 1960, United States.

A linear radiation detector is given which comprises a slab of p-type silicon having a p-n junction near one surface of the slab. Reverse bias establishes a depletion layer which has a depth of 1 micron extending from the face of the detector into the crystal. The specific resistivity of that portion of the crystal confined by the face and the p-n junction relates to the specific resistivity of the other (main) portion of the crystal like $1:10^6$ at most. By relating the specific resistivities of the two portions of the

crystal on both sides of the p-n junction in the said manner, it is achieved that practically all incident particles are counted independent of their energy or mass. (Gmelin Inst.)

25859 GAS-FLOW COUNTER. Julius Bosch, Rudolf Neuwirth, and Lotrhar Kranz (to Frieseke and Hopfner GmbH). German Patent 1,163,989. Feb. 27, 1964. Filed Oct. 27, 1961.

The gas-flow counter described has a flat box-like active volume and counter wires extended parallel to the plane of incidence of the radiation. A single wire is extended in form of an equilateral triangle between three thin needles, which are attached to a member arranged outside the housing and are lead into the active volume through openings in the housing insulated therefrom. The member supporting the needles is connected to a high-voltage source. (Gmelin Inst.)

25860 DESIGN AND CONSTRUCTION OF MINIATURE FISSION CHAMBER. E. Artacho, E. Rufián, and J. Montes (Junta de Energia Nuclear, Madrid). Anales Real Soc. Espan. Fis. Quim. (Madrid), Ser. A, 59: 157-62(July-Aug. 1963). (In Spanish)

The design and operation of a small fission chamber are described. The chamber pressure was fixed at 5 atm. to obtain early discrimination of the fission and α pulse. The influence of gas pressure on the pulse spectra is discussed, and chamber operating characteristics are given. (L.B.S.)

25861 THREE METHODS OF ENERGY MEASUREMENT IN A BREMSSTRAHLUNG BEAM WITHIN THE RANGE OF $E_{\gamma max}$ = 15 TO 80 Mev. S. P. Kruglov and I. V. Lopatin. At. Energ. (USSR), 16: 258-60(Mar. 1960). (In Russian)

In view of the importance of quantitative data on bremsstrahlung for radiation physics and for nuclear reactions, the results of measurements carried out within the range from 15 to 80 Mev by means of cascade curves, calorimetric measurements, and the quantum meter method were examined. The calorimeter studies indicated that more than 93% of the γ quanta were transformed into heat energy. The previously described extrapolation chamber was used for the transition curve (cascade) method. The quantum meter consisted of 12 1-cm thick Cu plates, separated by 0.15 cm gaps. Analysis of the results indicated that the standard deviations in measurements by the transition curve and the quantum meter techniques include uncertainties in addition to the experimental error. These errors may be eliminated by a direct comparison of the data. At high energies, the transition curve method allows a satisfactory integration; however, when the threshold is reduced, the maximum of the transition curves shifts toward the lower values and relatively large errors are made when integrating the initial portion of the curve. This may be avoided by a suitable choice of the parameters. A tandem quantum-meter, consisting of 2 sets of plates with thicknesses of 0.4 and 0.8 cm, yielded less energy-dependent results. After analysis, it was found that the data obtained by the three methods agree quite well with each other. An error of 1% may be present throughout the studied range. (TTT)

25862 CARE AND MAINTENANCE OF NUCLEAR INSTRUMENTS. Carl L. Henry. Atomics, 17: No. 3, 31-3 (May-June 1964).

The performance of general service on various survey meters, such as ion chambers and Geiger (GM) counters, and tips on overcoming some of the more common troubles are discussed. Some schematic diagrams are presented. (P.C.H.)

25863 TIME-OF-FLIGHT SPECTROMETER FOR THERMAL NEUTRONS. Ir. K. L. A. Weimar. Atoomenergie Haar Toepassingen, 6: 54-65(Mar. 1964). (In Dutch)

A description is given of the time-of-flight spectrometer erected at the Low Flux Reactor at Petten. The spectrum of thermal neutrons from the beam hole can be measured with this device. Measurements made on some metal hydrides to determine their thermal neutron transmission are reported as examples. (tr-auth)

25864 STUDY OF SOME SCINTILLATING GELS IN VIEW OF THE MEASUREMENT OF MINERAL SALT BETA EMITTERS OF MAXIMUM ENERGY GREATER THAN 0.5 Mev. Georges Germai (Universite, Liege). Bull. Soc. Roy. Sci. Liege, 32: 863-72(1963). (In French)

The possibility of using scintillating gels to count the weak beta activities of mineral salts was studied. The pulse heights provided by some scintillating gels were compared. The best scintillation yield was obtained with a gel composed of toluene, 5 g/l of PPO, 0.05 g/l of POPOP, 100 g/l of naphtalene, and 6.2% by weight of Aerosil 2491. (D.C.W.)

25865 THE DETERMINATION OF THE ABSOLUTE AND RELATIVE EFFICIENCY OF A 2″ × 2″ NaI(Tl) CRYSTAL BY THE GRAPHIC METHOD. A. Peetermans (Universite, Liege). Bull. Soc. Roy. Sci. Liege, 32: 873-80(1963). (In French)

The absolute and full-energy-peak efficiencies of an NaI(Tl) crystal for use in scintillation spectrometer were determined. Gamma absorption in the scintillator envelope was taken into account. (D.C.W.)

25866 COUNTING EFFICIENCY OF NUCLEAR MULTIPLATE CAMERA. Chia Yi Huang, Jenn Lin Hwang, Yuin Chi Hsu, and Yuin Kwei Tai (National Taiwan Univ., Taipei). Chinese J. Phys. (Taiwan), 1: 33-8(Oct. 1963).

A nuclear multiplate camera was constructed to observe nuclear processes resulting from the bombardment of rectangular targets with a neutron beam. Twelve Ilford K-2 plates are held in a rigid geometry which allows simultaneous measurements of nuclear reaction at angles of 15 to 165°. The counting efficiency of a nuclear plate was calculated. As a check, measurements of efficiency were made by counting the number of alpha particles on the nuclear plates from a ^{210}Po source electroplated on the target. The results are in good agreement with the calculated values. (auth)

25867 PHOTOVOLTAIC CELL X-RAY EXPOSURE RATE METER. P. Gangadharan, S. Jayaraman, H. K. Pendurkar, and A. Sankaran (Atomic Energy Establishment, Trombay, India). Health Phys., 10: 323-30(May 1964).

An exposure-rate meter, comprising a DP5 photovoltaic cell of International Rectifier Corporation and a ZnS–CdS(Ag) scintillator, can monitor x-radiation exposure rates of 5 to 1000 r/min. When the phosphor is stimulated by x radiation, it emits light which falls on the photovoltaic cell. The instrument is very simple and rugged. It needs no batteries, vacuum tubes, or other auxiliary equipment. All that is required is a photovoltaic cell with a scintillator and a sensitive current measuring device. Because of a low impedance involved, the two components can be connected by lengthy cables. An electrical compensation circuit is incorporated to make up for the non-linearity. A sensitivity of 0.28 μA/r/min has been attained for 150 kv x rays. The instrument is energy independent in the range of 0.065

to 1 mm of half value layer of Cu which approximately corresponds to an x-ray tube voltage of 100 to 180 kv with an accuracy of ±10%. The probe has negligible angular dependence when it makes an angle of ±20° to the direction of x-ray beam. This instrument will be suitable for remote measurement of table top doses encountered in fluoroscopy and also is suited for continuous monitoring of x-ray beam. The necessary correction graphs are included. (auth)

ISOTOPE TECHNOLOGY

General

25868 (OTS-63-11008) SELECTED ARTICLES ON USE OF ISOTOPES IN RESEARCH. Translated from Russian IPST Cat. Nos. 683, 684, and 832. 1964. 21p.

Selected papers on the use of isotopes in research, translated from Russian IPST Cat. Nos. 683, 684, and 832, are presented. Separate abstracts were prepared for each of the three papers. (M.C.G.)

For abstracts of individual papers see: 25058, 25059, and 25699.

25869 A NEW ISOTOPE OF LEAD: ^{213}Pb. F. D. S. Butement, V. J. Robinson, and S. M. Qaim (Univ. of Liverpool). J. Inorg. Nucl. Chem., 26: 491-2(Apr. 1964).

^{213}Pb was isolated from the descendants of ^{221}Em, and the half life found to be 10.2 ± 0.3 min. (auth)

Industrial Applications

25870 (MLM-1154) HEATING VACUUM-TUBE CATHODES WITH POLONIUM-210: FEASIBILITY STUDY. A. J. Rogers, J. F. Eichelberger, and R. A. Miller (Mound Lab., Miamisburg, Ohio). May 27, 1964. Contract AT(33-1)-Gen-53. 18p.

The feasibility of inducing thermionic emission from the cathodes of vacuum tubes using radioactivity, specifically by using polonium-210, was evaluated. Serious limitations, such as radioelement half life and pressure increase within the cathode core, restrict the use of radioelements in vacuum tubes to short tube-life uses. The materials of cathode construction affect the quantities of polonium required to produce minimal thermionic emission over the useful vacuum-tube life. Increased vacuum-tube noise levels must be prevented by carefully sealing the polonium into the cathode and thereby prevent the release of ionic particles into the vacuum-tube envelope. (auth)

25871 (SGAE-IB/IA-1/1964) UNTERSUCHUNGEN AN EINEM PNEUMATISCHEN MISCHSILO MIT 1.000 m^3 FASSUNGSVERMOGEN FUR ZEMENTROHMEHL MITTELS RADIOAKTIVER SUBSTANZEN. (Study on a Pneumatic Mixing Silo with 1,000 m^3 Capacity for Cement with Radioactive Substances). T. Cless-Bernert and K. Duftschmid (Österreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf, Austria). [1963]. 10p.

The mixing processes in a 1,000-m^3-capacity mixing silo for cement raw powders were investigated using radioisotopes. ^{24}Na in the form of the $NaHCO_3$ was used as the tracer. A topograph of the radioactive indicator in the raw material was obtained and its displacement during the mixing process was observed. The activity distribution in the upper third of the silo attained a constant value in about 20 min, while the activity variations in the bottom layers of the raw material were balanced by the mixing process after 60 to 90 minutes only to a small degree. (M.C.G.)

25872 ATOMIC ENERGY AND THE CHEMICAL INDUSTRY. P. S. Savitskii. At. Energ. (USSR), 16: 191-4 (Mar. 1964). (In Russian)

The radiation-chemical reactions taking place under the influence of ionizing radiation are reviewed. Chemical reactions represent a redistribution of electrons among the participating atoms and molecules possessing the required minimum activation energy. This energy is usually transferred by heating; therefore, in order to obtain an economically significant yield, the system must be kept at a high temperature and under high pressure. It was found that ionizing radiation can be used as a "clean catalyst" for accelerating certain reactions, acting without material admixture. Practical processes based on radiation were developed. They include the direct synthesis of HNO_3 from the elementary gases, oxidation of SO_2 to SO_3, synthesis of hydrazine from NH_3, cracking of petroleum products at lower temperatures than previously and obtaining a higher yield of unsaturated hydrocarbons, oxidation of hydrocarbons, as the formation of phenol from benzene, preparation of P, As, and Si containing hydrocarbon derivatives, haliding, sulfonation, and sulfochlorination processes, and many others. The radiation-chemical reactions were evaluated on the basis of the G number, designating the number of molecules reacted per 100 ev of the absorbed radiation. It appeared desirable to design a completely new reactor type for radiation-chemical studies. (TTT)

25873 USE OF ACTINIUM–BERYLLIUM NEUTRON SOURCES FOR INDUSTRIAL GEOPHYSICAL INVESTIGATIONS. R. L. Kaipov, D. M. Ziv, D. I. Leĭpunskaya, S. I. Savosin, V. V. Fedorov, G. M. Fradkin, Yu. S. Shimelevich, Ya. N. Basin, N. K. Kukharenko, and B. I. Shestakov. At. Energ. (USSR), 16: 269-70(Mar. 1964). (In Russian)

Po–Be sources have a disadvantage in industrial applications because of the short half life of ^{210}Po, while Ra–Be sources possess a strong γ radiation, which renders the work difficult. Therefore, Ac–Be sources were tested as to their suitability for geophysical studies under field conditions. The source has a neutron efficiency of 1.7 to 2.0 × 10^7 n/sec curie and its soft, <50 kev γ radiation can be easily shielded as only 13% of the ^{227}Ac decay events emit γ quanta with energies higher than 0.8 Mev. The spatial distribution of the thermal and fast neutrons is close to that of a Po–Be source. This source was used on an industrial scale in a 1-cm thick Pb container; under those conditions the γ dose amounted to 1.12 mr/hr per 10^6 n/sec at 1 m or about 0.4 of the maximum permissible dose. Field tests in the oil fields of the Tartar Republic indicated that the associated γ radiation does not interfere with the neutron–γ logging. The source was found to be less satisfactory for porosity measurements. It was concluded that the source may be used for activation analysis and for many types of geological γ-logging but not for determination of the porosity of soils. (TTT)

25874 ABSORPTION OF γ RAYS IN SOLID FUELS DURING GASIFICATION. A. S. Nestrakhov. Izv. Akad. Nauk SSSR, Energ. i Trans., No. 2, 266-9(Mar.-Apr. 1964). (In Russian)

A method is suggested for determining the density and chemical composition of solid layers at the gasification zone using γ sources. Tm^{170} (0.085 Mev) and Co^{60} (1.25 Mev) were used for studying physico-chemical parameters of gasification of solid fuels and automatic slag disposal processes. (tr-auth)

25875 NEW TECHNIQUE FOR THE PRODUCTION OF CARRIER-FREE ^{18}F. G. A. Nagy and K. Berei (Central Research Inst. for Physics, Budapest). J. Inorg. Nucl. Chem., 26: 659-61(Apr. 1964).

A rapid method is described for the high yield production of ^{18}F. The apparatus is easily assembled from conventional laboratory tools, which permits the processing of the irradiated target not only in the laboratory where it has been produced but wherever the sample is being applied. The isotope is produced in the 10^{13} n/cm^2 sec thermal flux in one of the research reactor channels by the sequence of reactions $^6Li/n, t/^4He$ and $^{16}O/t, n/^{18}F$. As target material lithium carbonate is preferable to lithium nitrate because of the better thermal stability of the former. (P.C.H.)

Separation and Production

25876 (ORNL-IIC-2) PRODUCTION OF CALCIUM-47— WITH LITERATURE REVIEW OF USES. P. S. Baker, Martha Gerrard, and Robert H. Lafferty, Jr. (Oak Ridge National Lab., Tenn.). [196?]. Contract W-7405-eng-26. 17p.

^{47}Ca is produced by the $^{46}Ca(n,\gamma)^{47}Ca$ reaction in a high-flux reactor from target material electromagnetically enriched in ^{46}Ca. The product has a $^{47}Ca/^{45}Ca$ ratio of >20 : 1 and is currently made at a rate of 25 mc/month. Some of the literature (80 references) on properties and uses of ^{47}Ca is also reviewed here. (auth)

25877 (ORNL-3400) OAK RIDGE NATIONAL LABORATORY TARGET PREPARATION PROGRAM. [E. H. Kobisk] (Oak Ridge National Lab., Tenn.). Jan. 15, 1963. Contract W-7405-eng-26. 14p.

In early 1961 a Target Fabrication Center was established to carry out the routine preparation of a wide variety of targets and to provide research and development support to the target program. Although most of the effort concerns enriched stable isotopes, both normal and radioactive materials are also handled. With the aid of rolling mills, resistance-heat and electron-bombardment vacuum evaporators, presses, and electroplating equipment, targets of elements and compounds are prepared which cover a broad range of thicknesses and sizes, in both supported and self-supporting forms. Thicknesses vary from a few microinches to dimensions limited in many cases only by the amount of material available. Although there are certain limitations imposed by chemical reactivity, the development effort is being directed toward the ultimate availability of self-supporting targets of most elements and compounds. (auth)

25878 (JPRS-23767(p.7-28)) THE PRINCIPLE OF GAS CENTRIFUGAL SEPARATION AND ITS APPLICATIONS IN ISOTOPIC SEPARATION. Huai-hsin Kan. Translated from Hua Hsueh T'ung Pao, No. 10, 534-9(1961).

This paper was previously abstracted from the original language and appears as NSA 18: 5711. (L.T.W.)

MATHEMATICS AND COMPUTERS

25879 (AWRE-O-4/64) A DATA LISTING PROGRAMME FOR THE U.K.A.E.A. NUCLEAR DATA LIBRARY. D. M. Jarman, K. Parker, and E. D. Pendlebury (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). May 1964. 19p.

A description is given of the IBM 7030 Fortran program NDF PRINT, which produces annotated listings of the neutron cross section data in the U.K.A.E.A. Data Library from the tape on which the data are stored. This report should read in conjunction with either AWRE-O-70/63 or AEEW-R277. (auth)

25880 (NAS-NRC-Pub-1184(p.247-54)) THE USE OF ATLAS ON-LINE. E. H. Cooke-Yarborough (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

The use of a Ferranti Atlas computer on-line with NIMROD at Harwell is discussed. The machine capabilities are described. (R.E.U.)

25881 (NAS-NRC-Pub-1184(p.266-8)) COMPUTER TECHNIQUES. G. Bell (Digital Equipment Corp., Maynard, Mass.).

A magnetic tape recording system called Micro Tape, a magnetic drum storage unit, and the PDP-5 computer are described. (R.E.U.)

25882 (NAS-NRC-Pub-1184(p.269-70)) SDS 9300-PRELIMINARY SPECIFICATION. E. R. Borgers (Scientific Data Systems, Santa Monica, Calif.).

Memory and input/output configurations are shown. (R.E.U.)

25883 (NAS-NRC-Pub-1184(p.271-82)) A TIME-SHARED COMPUTER FOR REAL-TIME INFORMATION PROCESSING. J. Leng, J. A. Quarrington (Atomic Energy of Canada Ltd. Chalk River Nuclear Labs., Chalk River, Ont.); P. K. Patwardhan (India. Atomic Energy Establishment, Trombay); and G. Bell (Digital Equipment Corp., Maynard, Mass.).

The present use of the Electronic Data Analyzing Center at Chalk River on a time-shared basis is discussed with application to nuclear pulse analysis. (R.E.U.)

25884 SOLUTIONS IN A SPECIAL CASE OF THE PARTIAL DIFFERENTIAL EQUATIONS ASSOCIATED WITH THE APPELL FUNCTION F_2. Per O. M. Olsson (Royal Inst. of Tech., Stockholm). Arkiv Fysik, 25: 473-80(1964).

Solutions of the partial differential equations associated with Appell's hypergeometric function $F_2(a, b_1, b_2, c_1, c_2, x, y)$ are given for $a = 1$. This choice gives immediately three of the four independent solutions in terms of the hypergeometric functions F_1 or related functions. From a previous investigation analytic continuations of these three solutions are easily obtained. These continuations are all expressed in terms of hypergeometric functions of order two and give the behavior of the solutions near singular points. The fourth solution is expressed in a series of ${}_3F_2$ functions. Its analytic properties can be studied with the aid of results obtained by Norlund, who investigated the solutions of the differential equations associated with the functions ${}_pF_{p-1}(x)$. (auth)

25885 THE GUS MULTICOMPUTER SYSTEM. W. F. Miller and R. A. Aschenbrenner (Argonne National Lab., Ill.). IEEE (Inst. Elec. Electron. Engrs.) Trans. Electron. Computers, EC-12: 671-6(Dec. 1963).

The GUS (GEORGE Unified System) computer system is used to investigate the problems of multicomputer systems. The interactions between man and machines as well as between multiple machines are studied. The structures and function of each unit of the system are described, and the programming systems developed for GUS are summarized. (D.C.W.)

25886 DETERMINANTAL METHOD IN PERTURBATION THEORY. Tatuya Sasakawa (Univ. of California, Los Angeles). J. Math. Phys. (N. Y.), 5: 379-82(Mar. 1964).

The determinantal method of deriving fundamental relations of a new perturbation theory, which was presented recently is demonstrated. This method is simpler than the Green's function method, which was adopted in the previous paper (NSA 17: 31146). The Brillouin–Wigner perturbation theory is discussed for comparison. (auth)

25887 TWO THEOREMS IN THE APPROXIMATION OF FUNCTIONS OF TWO VARIABLES BY POLYNOMIALS OF THE BERNSTEIN-TYPE. P. V. Lambert (Université, Louvain, Belg.). Simon Stevin. Wis- Natuurk. Tijdschr., 36: 122-30(Feb. 1963). (EUR 505.e)

The approximation of functions of two variables in the triangle $S = [(x,y);\ 0 \le x,\ 0 \le y,\ x + y \le 1]$ by polynomials constructed by assigning the trinomial weights $p_{n,k,m}(x,y) = [n!/k!\ m!\ (n-k-m)!]\ x^k y^m (1-x-y)^{n-k-m}$ to the function values at the points $(k/n, m/n)$, $(k = 0, 1, \ldots, n;\ m = 0, 1, \ldots n;\ k + m \le n)$ is studied for each fixed $n = 1,2, \ldots$. An estimation formula of the approximation degree as a function of n is established using the C-norm. Then an asymptotic relation for functions with 2nd order differential is proved. (auth)

25888 "ON-LINE" OPERATION OF A DIGITAL COMPUTER IN NUCLEAR PHYSICS EXPERIMENTS. J. F. Whalen, J. W. Meadows, and R. N. Larsen (Argonne National Lab., Ill.). Rev. Sci. Instr., 35: 682-90(June 1964).

Instrumentation developed for coupling a commercial digital computer directly to multiparameter experiments and displaying the data accumulated by the computer is described. The use of the on-line system in some neutron time-of-flight measurements, fission fragment mass ratio measurements, and measurements of prompt $\bar{\nu}$ for fissionable materials is also discussed. (D.C.W.)

25889 LOW COST DIGITAL TAPE STORE. Curtis C. Rockwood and Gerald A. McGinnis (Argonne National Lab., Ill.). Rev. Sci. Instr., 35: 751-2(June 1964).

The ANL balloon-borne system for observing gamma activity in the upper atmosphere converts pulse amplitudes produced by a scintillation detector into pulse widths for transmission to the ground. A tape unit developed for recording the transmitted data at the experimental sites for subsequent analysis at ANL is described, together with its operation. The unit costs about $2000. (D.C.W.)

25890 ON SOME PROBLEMS IN THE THEORY OF PARTICLE COUNTING AND QUEUES WITH INFINITELY

MANY SERVERS. Joseph Lewis Gastwirth. Thesis, New York, Columbia Univ., 1963. 95p.

A new elementary proof of Pyke's integral formula is presented for the distribution of the time between consecutive registrations in the Type I counter. The main body of this study is concerned, however, with the Type II counter. It is assumed that particles arrive at a Type II counter at the times $\tau_1, \tau_2, \ldots$ ($n = 1, 2, \ldots; \tau_0 = 0$), where the inter-arrival times $\theta_n = \tau_n - \tau_{n-1}$ are independent, identically distributed random variables with the common distribution function F(x). Each particle, at the time of its arrival, produces an impulse in the counter. The durations of the impulses produced by the particles are not only mutually independent random variables but also independent of the sequence $\{\tau_n\}$. Denote by χ_n the duration of the impulse produced by the n-th particle. The $\{\chi_n\}$, therefore, are independent, identically distributed random variables with distribution function H(x). Those particles that arrive when the counter is free are registered. The sequence of times $\tau_1^1, \tau_2^1, \ldots$ ($n = 1,2, \ldots; \tau_0^1 = 0$) when a particle arrives and is registered forms a subsequence of $\{\tau_n\}$. The times between consecutive registrations are also independent, identically distributed random variables. Formulas for the binomial moments of the number of impulses present in the counter at time t (equivalently the queue size of a queueing system with infinitely many servers at time t) are given when the impulse times follow either an Erlang law or a max-m law. A max-m distribution is the distribution of the maximum of m independent, exponential random variables, each with the same parameter. These formulas are derived by solving Prof. Takács' recurrence system of integral equations between the successive binomial moments. From the point of view of particle counting, the main problem is to find the asymptotic distribution of the number of registrations at time t. In order to do so, it is necessary to determine the mean and variance of R, the time between consecutive registrations. No progress was made on this problem if the impulse time followed an Erlang law. When the impulse times are distributed according to a max-m law, however, the mean of R could be determined by considering the imbedded Markov chain of a related batch arrival queueing system. Unfortunately, the problem of determining the variance of R seems much more difficult, even when the impulse time obeys a max-m law. The final chapter is devoted to a modified version of a problem discussed by Prof. W. M. Hirsh concerning the application of queueing theory to missile defense systems. Under the assumption that the base is well fortified (i.e., has infinitely many missile batteries), a loss function is introduced and evaluated. The loss function takes into account the number of planes shot down during the attack, the number of planes that were not shot down but that did not participate effectively in the attack, and the time it takes to destroy the base. (Dissertation Abstr.)

METALS, CERAMICS, AND OTHER MATERIALS

General

Refer also to abstracts 26824 and 26946.

25891 (ANL-6868) ANNUAL REPORT FOR 1963, METALLURGY DIVISION. (Argonne National Lab., Ill.). Contract W-31-109-eng-38. 448p.

Developments made in metallurgy at Argonne National Laboratory are reported. The report is divided into two parts with each part having ten sections; abstracts are given for these twenty sections. (N.W.R.)

For abstracts of individual papers see: 25675, 25892, 25893, 25919, 25920, 25939, 25966, 25967, 25968, 25969, 25970, 25971, 26069, 26522, 26893, 26894, 26895, 26896, 26897, and 26898.

25892 (ANL-6868(p.234-66)) METALLURGY OF PLUTONIUM. (Argonne National Lab., Ill.).

The metallurgy of plutonium is studied and evaluated. Information is included on: preparation of high-purity monocrystals, fabrication by rolling, electric conductivity, grain growth, recrystallization, strain hardening, hardness, density, metallography, phase studies, heat treatments, chemical analysis, radiation damage, electronic structure, transformation behavior, alloying with neptunium, heterogeneous systems, thermal cycling, x-ray diffraction analysis, ductility, and magnetic ordering. (N.W.R.)

25893 (ANL-6868(p.355-72)) CERAMIC MATERIALS RESEARCH. (Argonne National Lab., Ill.).

The crystal structure, phase studies, electric conductivity, and thermodynamic properties of plutonium dioxide crystals are investigated. The thermodynamic properties and reaction kinetics of iron oxide- and nickel oxide-plutonium oxide electrolytic cells are evaluated. The decomposition of nitrous oxide using oxide catalysts is described. Deuteron and uranium-235 fission fragment effects on magnesium oxide crystals are studied with respect to annealing and hardness effects. The preparation and properties of aluminum oxide, cobalt oxide, and molybdenum oxide crystals are discussed. (N.W.R.)

25894 (NMI-2128) FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. Monthly Progress Report to the United States Atomic Energy Commission for the Month of April 1964. (Nuclear Metals. Div. of Textron Inc., West Concord, Mass.). June 12, 1964. Contract AT(30-1)-2784. 56p.

Fabrication of Tungsten and Tungsten-Rhenium Tubing. Extrusions of W and W-25 Re tubes were successful. Drawing techniques are being developed. Ring compression data are available to show the effects of extrusion conditions and annealing. Fundamentals of Single-Crystal Deformation in Zone-Refined Beryllium. At the highest purity level attained (12 passes on single-distilled Be), enhanced basal glide capacity and increased resistance to basal cleavage were observed. Chemical analyses are reported on crystals of L-6RNi and L-6R(Fe + Al + Si). Development of Uranium Slis Alloys. Splatcooled U-Be, U-Be-C, U-C, and Zircaloy-2-1.14 wt % Be alloys were produced. Tensile tests are reported for the U-Be-C and Zr-1.14 wt % Be splatcooled alloys. (D.L.C.)

25895 (NUMEC-2389-3) DEVELOPMENT OF PLUTONIUM-BEARING FUEL MATERIALS. Monthly Progress Letter for February 1964. Karl H. Puechl (Nuclear Materials and Equipment Corp., Apollo, Penna.). Mar. 10, 1964. Contract AT(30-1)-2389. 6p.

Pu wire was extruded in preparation for growth of single Pu crystals. Hammermilling of UO_2-PuO_2 powders was found to result in high metallic impurity pickup. Flocculation tests for Pu recovery were carried out on filtrates from the preparation of UO_2-PuO_2. (D.L.C.)

25896 (PF-63-3) DEVELOPMENT OF PRACTICAL TECHNIQUES FOR APPLYING PROTECTIVE COATINGS TO COLUMBIUM ALLOYS. Quarterly Progress Report No. 3, December 1, 1962-February 28, 1963. J. Zupan, P. J. Chao, and J. B. Whitney (Pfaudler Co., Rochester, N. Y.). Mar. 15, 1963. Contract AF33(657)-8920. 28p. (N63-14743)

Practical techniques for applying protective coatings to columbium alloys are being investigated by studying three coating processes: fused salt bath, fluidized bed, and slurry dip and spray application. The use of D-14 alloy (Cb-5Zr), 20 mils thick, is being continued as the substrate. In the fused salt bath work, deposition of chromium and titanium continued to be investigated, with emphasis being placed on bath composition and selection of bath container material. The bulk of the work on fluidized bed deposition has continued to be concerned with the investigation of basic process variables. Metallographic evaluation of the samples is being employed to determine the optimum combination of these variables. Studies of slurry dip and spray technique have included investigation of the effects of process variables such as firing time and the use of flake vs. granular aluminum and tin powders. Since granular powders produce better coatings, means of improving their suspension properties will be investigated. The new electrophoresis equipment is being used to study the basic mechanisms of these suspension properties. (auth)

25897 THE METHOD OF NEUTRAL PSEUDO-ATOMS IN THE THEORY OF METALS. J. M. Ziman (Commonwealth Scientific and Industrial Research Organization, Sydney). Advan. Phys., 13: 89-138(Jan. 1964).

The treatment of metals as an assembly of neutral "atoms" (ion + screening charge) is reviewed. Potentials, phase shifts, band structure, interatomic forces, liquid metal resistivity, electron-phonon interaction, defects, and impurities are covered. (D.C.W.)

25898 ZIRCONIUM. ITS PRODUCTION AND IMPORTANCE. V. K. Shah (Indian Inst. of Tech., Bombay). Bombay Technologist, 12: 92-6(1962).

Applications of Zr in the form of refractories, vitreous enamels, and certain alloys, and in the field of nuclear energy are discussed. The production of Zr metal is included. (P.C.H.)

25899 SOME PARTICULAR ASPECTS OF THE ACTIVITIES OF THE URANIUM PRODUCTION PLANT AT LE BOUCHET. M. Delange, R. Falcoz-Vigne, C. Le Roy, and O. Tachon. Bull. Inform. Sci. Tech. (Paris), No. 80, 11-56(Feb. 1964). (In French)

Some developments since 1959 in production techniques

and in installations for the production or treatment, in parallel with normal production work, of uranium-containing compounds other than metallic uranium are reviewed. Transformation lines for uranium, processes for UO_2 and UF_4 production, and uranium ingot production by calciothermy and magnesiothermy are described as illustrative results. (D.C.W.)

25900 THE INDUSTRIAL SINTERING OF URANIUM DIOXIDE. R. Hauser. Bull. Inform. Sci. Tech. (Paris), No. 80, 117-34(Feb. 1964). (In French)

The specifications for the fuel of the ELA reactor and the principles of the process by which it is produced are given. The production lines that have already been set up, capable of producing 2 metric tons/month, are then described; and the quality controls are summarized. The results of density determinations made for sintered products at the startup of the line are included. (D.C.W.)

25901 SOME ADVANCES IN METALLURGICAL PRACTICE INTRODUCED FOR NUCLEAR ENGINEERING. L. Rotherham (Central Electricity Generating Board, London). J. Inst. Metals, 92: 257-64(May 1964).

A review is presented on methods of processing uranium by ion exchange, solvent extraction, fluidized-bed techniques and vacuum casting, and adjustment of metallic uranium to meet service conditions that can include inspection, heat-treatment, and on-site welding. The development of graphite as a structural material is also considered. It is shown how solutions to these individual problems together constitute a significant step forward in the technology of nuclear engineering and how this has brought important advances in metallurgical practice. (P.C.H.)

25902 PICKLING OF ZIRCONIUM ALLOYS. H. G. Zimmermann (Thermatom AG, Winterthur, Switzerland). J. Nucl. Mater., 11: 247-8(Feb.-Mar. 1964).

Pickling of Zr alloys is discussed and equations are given for extrapolation to a technological scale. Examples of the extrapolation are given. (P.C.H.)

25903 VARIATION OF THE MÖSSBAUER EFFECT DUE TO PLASTIC DEFORMATION IN STEEL. G. N. Belozerskii and Yu. A. Nemilov. Soviet Phys.-Solid State (English Transl.), 5: 2457-8(May 1964). Translated from Fiz. Tverd. Tela, 5: 3350-2(Nov. 1963).

The Mössbauer effect was investigated in steel absorbers after they were subjected to plastic deformation and annealing. It is shown that an extensively rolled unannealed foil does not exhibit any Mössbauer effect and that annealing and, consequently, reestablishment of the crystal structure results in the appearance of an appreciably large effect. (C.E.S.)

25904 PRECIPITATION OF THORIUM FROM THORIUM–MAGNESIUM BY LIQUID LITHIUM. L. A. Hanson (Atomics International, Canoga Park, Calif.). Trans. Met. Soc. AIME, 230: 2-6(Feb. 1964).

A process using liquid Li for recovering Th from Th–Mg alloy was investigated on a gram scale. Dissolution of Th–Mg alloy in liquid Li metal resulted in the formation of a Li–Mg alloy solution and the precipitation of Th as a finely divided solid. Thorium separation was accomplished by filtration through stainless-steel filters. Over 99.7% of the Th was recovered in the precipitated residue. The concentration and final consolidation of separated Th was briefly studied. (auth)

25905 SELTENE METALLE. BAND I. BERYLLIUM, BOR, CÄSIUM, GALLIUM, GERMANIUM, HAFNIUM. (Rare Metals. Volume I. Beryllium, Boron, Cesium, Gallium, Germanium, and Hafnium). W. Schreiter. Leipzig, VEG Deutscher Verlag fur Grundstoffindustrie, 1963. 343p. DM 28,--.

The importance of rare metals in modern technology is discussed. Special characteristics and properties of the rare metals, methods of obtaining them, obtaining rare metals of high purity, processing of the rare metals, their effects on the human organism, and the inflammability of the rare metals are described. Beryllium, boron, cesium, gallium, germanium, and hafnium were especially considered. (M.C.G.)

25906 VANADIN, NIOB, TANTAL. DIE METALLURGIE DER REINEN METALLE UND IHRER LEGIERUNGEN. REINE UND ANGEWANDTE METALLKUNDE IN EINZLDARSTELLUNGEN, 18. (Vanadium, Niobium, and Tantalum. The Metallurgy of the Pure Metals and Their Alloys). Richard Kieffer and Horst Braun. Berlin, Springer-Verlag, 1963. 358p. DM 76.

The history and occurrence of the vanadium metals, vanadium, niobium, and tantalum, are reviewed. Methods of ore treatment for the preparation of V_2O_5, Nb_2O_5, and Ta_2O_5 and for separation of niobium and tantalum are described. Pure vanadium metal is reported to be prepared by: reduction of the oxide by aluminum, carbon, or calcium; reduction of the chloride by magnesium or hydrogen; thermal decomposition of vanadium iodide; electrolytic refining; or electrolysis of aqueous solutions. Methods described for the preparation of pure niobium and tantalum metals include: reduction of oxide by carbon; reduction of halides; thermal decomposition of halide; or melt electrolysis. Fabrication methods used for the vanadium metals are discussed and evaluated. Physical and mechanical properties and corrosion behavior are described. Preparation and properties of alloys of niobium, tantalum, and vanadium are reported. Metallography, chemical analyses, and uses of the vanadium metals are discussed. (M.C.G.)

25907 ADVANCES IN MATERIALS. Inter-Disciplinary Symposium, Manchester College of Science and Technology, 6-9 April, 1964. First, Second, Third, Fourth, Fifth, and Sixth Sessions, 6-9 April, 1964. London, The Institution of Chemical Engineers, 1964. 759p.

Developments in the field of materials research are discussed. The materials include metals, ceramics, refractories, semiconductors, rubber, polymers, plastics, concretes, and glasses. Structure, properties, and fabrication methods are presented. Corrosion, diffusion, and radiation studies on reactor materials are also outlined. Thermionic materials and materials for discharge tubes are also considered. Separate abstracts are prepared for 11 of the 30 papers presented. (C.E.S.)

For abstracts of individual papers see: 25937, 25955, 26058, 26059, 26060, 26061, 26095, 26096, 26259, 26806, and 26946.

25908 EXTRACTIVE METALLURGY OF ZIRCONIUM AND HAFNIUM. A. W. Schlechten (Colorado School of Mines, Golden). 9p. (CONF-524-1)

From American Institute of Mining, Metallurgical and Petroleum Engineers Annual Meeting, New York, Feb. 1964.

A résumé of the development of zirconium and hafnium production in the U. S. is followed by a statement of present production facilities and statistics both in the U. S. and abroad. Different approaches to reduction and refining are

listed and some speculations made as to future changes. (auth)

25909 IMPROVEMENTS IN OR RELATING TO PLIABLE SHEETING FOR SOUND PROOFING AND OTHER PURPOSES. Werner Treuherz, Stanley Wolstenholme, and Stanley Hallowell (to Everglades Ltd.). British Patent 957,816. May 13, 1964. Filed Mar. 23, 1962.

A composite pliable sheeting material with sound proofing, flame resisting, and/or radiation shielding properties is described. The material comprises a sandwich of a pair of outer layers or coatings of plastic and an intermediate layer containing lead, lead compounds, tungsten, or tungsten compounds. The intermediate layer may be formed from a paste of polyvinyl chloride powder and lead powder. A plasticizer is provided in all three layers, and this may be partly an alkyl aryl phosphate which has a high fire resisting quality. Boric acid or antimony oxide may also be added to the plasticizer to increase its fire resistance. An example of the material and its fabrication is given. (D.L.C.)

25910 IMPROVEMENTS IN OR RELATING TO URANIUM ALLOYS. Gerard Slattery and Eric Ross (to United Kingdom Atomic Energy Authority). British Patent 958,620. May 21, 1964. Filed Apr. 19, 1962.

An alloy of U, Fe, and Al which exhibits a minimum growth under irradiation, contains 400 to 435 ppm Fe and 525 to 935 ppm Al. Its production includes a beta quench and an alpha anneal. Data on the irradiation growth of rods and on the failure of sheathed fuel rods containing varying amounts of Fe and Al are tabulated. (D.L.C.)

25911 IMPROVEMENTS IN OR RELATING TO METHODS OF PLATING URANIUM WITH MAGNESIUM. Oliver Flint (to United Kingdom Atomic Energy Authority). British Patent 958,717. May 27, 1964. Filed Mar. 28, 1962.

A process is given for forming a Mg film on the surface of U metal. The process comprises heating a Mg–$CuBr_2$ mixture at 550°C for 5 hr in the presence of U metal at 10^{-4} to 10^{-5} mm Hg pressure, in the absence of O_2 and H_2O. The concentration of $CuBr_2$ in the mixture may be 5 to 30% and is preferably 20%. An apparatus for carrying out the process is described. The probable reactions taking place during the process are discussed. (D.L.C.)

25912 IMPROVEMENTS IN OR RELATING TO METHODS OF AND APPARATUS FOR THE PREPARATION OF PURE METALS. Henrick Kahan, Andre Pattoret, and Roger Platzer (to Commissariet à l'Energie Atomique). British Patent 958,820. May 27, 1964. Priority date May 26, 1961, France.

A method is given for preparing in high purity one of the alkali metals, alkaline-earth metals, Mg, Be, or Mn. The method comprises heating a compound of the metal at a reduced pressure in a crucible to volatilize its constituents, and condensing the metal on a condensation surface having an adjustable temperature and/or position. The apparatus also has baffles between the crucible and the condensation surface, and some of the baffles may form a chemical trap for some of the volatilized constituents. Three examples of the method are described in which Ca, Mg, and Be are prepared. (D.L.C.)

25913 PROCESS OF FUSION ELECTROLYSIS FOR METAL PRODUCTION. (to Elektrophysikalische Anstalt Bernard Berghaus). British Patent 959,189. May 27, 1964. Priority date Sept. 7, 1959, Switzerland.

A method is given for obtaining Be, Mg, B, Al, Ti, Zr, Th, and U by electrolysis of a salt melt containing alkali halides. The method is characterized in that NH_3 is added to the melt before or during electrolysis; the addition lowers the working temperature and reduces the development of smoke. The addition compound, which is usually instable in air, may be made stable by heat treatment. Examples of the method are given with particular reference to the preparation of Ti metal. (D.L.C.)

25914 METHOD OF TREATING METAL SURFACES AND APPLICATION OF THE METHOD. (to Borg Holding AG). British Patent 960,346. June 10, 1964. Priority date Jan. 15, 1962, Switzerland.

A method is given for cleaning and passivating surfaces in the atomic industry, e.g., heat exchanger surfaces. The method comprises treating the surface firstly with an inhibited acid, secondly with an oxidizing and complexing solution, and finally with a passivating solution. The passivating solution does not contain materials which have high neutron capture cross sections or which give off long-lived radiation upon neutron absorption, and may be a solution of dicyclohexyl amine nitrite and hydrazine. (D.L.C.)

25915 THE PREPARATION OF GRAPHITE FREE FROM BORON. Ernst Weingartner (to Deutsche Erdol AG). German Patent 1,164,994. Mar. 12, 1964. Filed Apr. 1, 1961.

The raw graphite containing 25 to 50 weight % water is kneaded and the pasty mush obtained is treated with a quantity of oil of 100 weight % at most. A detailed description of the whole method is given in a previous German patent 1,159,404, NSA, 18: 12572. (Gmelin Inst.)

25916 PRODUCTION OF URANIUM METAL POWDER IN A PULSED FLUIDIZED BED AND POWDER RESULTING THEREFROM. H. M. Heidt (to U. S. Atomic Energy Commission). U. S. Patent 3,135,599. June 2, 1964.

An improved method is presented for producing uranium powder. The method comprises maintaining said uranium hydride in a dispersed state in a fluidized zone in a fluidizing medium comprising a major proportion of an inert gas and a minor proportion of hydrogen, gradually heating said hydride in said zone to a temperature of from about 420°C to no greater than 550°C, periodically pulsing said fluidizing medium, and gradually reducing the hydrogen content from a maximum of 20% of the total gas flow through said zone to a minimum of no less than about 0.5% of said total flow until the uranium hydride has been decomposed to a uranium metal powder product. (AEC)

25917 CHROMIUM BASE ALLOY POSSESSING HIGH STRENGTH AT ELEVATED TEMPERATURES. L. R. Aronin and A. L. Geary (to U. S. Atomic Energy Commission). U. S. Patent 3,137,572. June 16, 1964.

Chromium alloys are described which are characterized by superior strength at high temperatures and which are capable of being hot worked and extruded. The alloys consist of Cr and minor percentages of tantalum and molybdenum or tantalum, molybdenum, and columbium. (AEC)

25918 IMPROVED TUNGSTEN ELECTRODES. Ellis L. Foster, Jr. and Ray R. Walker (to U. S. Atomic Energy Commission). U. S. Patent 3,138,453. June 23, 1964.

A tungsten electrode for arc-melting refractory metals is described which contains a small amount (~0.1%) of yttrium as a dispersion or a coating. Also, a process for arc-melting refractory metals in an inert atmosphere in a hearth is given which comprises superimposing yttrium metal on the refractory metal and establishing an arc be-

tween a tungsten electrode and the hearth whereby yttrium melts and coats the electrode and the refractory metal is melted. The yttrium protects the electrode from erosion. (AEC)

Corrosion

Refer also to abstracts 26059 and 26096.

25919 (ANL-6868(p.190-200)) DEVELOPMENT OF CORROSION-RESISTANT JACKETING AND STRUCTURAL MATERIALS. (Argonne National Lab., Ill.).

The corrosion of aluminum alloys, zirconium alloys, stainless steels, nickel, thoria-dispersed nickel, uranium dioxide, uranium dioxide-rare earth oxide systems, and aluminum powder products by water and steam at high temperatures is investigated. The corrosion of titanium by mercury is evaluated with respect to the inhibition properties of nickel in the corrosion tests. Cathodic protection of refractory alloys in oxygen-containing sodium is discussed. (N.W.R.)

25920 (ANL-6868(p.338-54)) CORROSION RESEARCH. J. E. Draley, S. Mori, R. K. Hart, R. A. Legault, D. H. Bradhurst, and W. E. Ruther (Argonne National Lab., Ill.).

Corrosion and oxidation studies of aluminum, aluminum alloys, and zirconium are evaluated experimentally and theoretically. The effects of oxidation on electric and mechanical properties are investigated. (N.W.R.)

25921 (AWRE-O-25/64) URANIUM COMPATIBILITY STUDIES. PART 2. THE EFFECT OF WATER VAPOUR PRESSURE IN AN OXYGEN FREE ATMOSPHERE ON THE CORROSION RATE OF URANIUM AT 100°C. S. Orman (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Apr. 1964. 17p.

The investigation has revealed that in an oxygen free atmosphere the corrosion rate of uranium is dependent upon water vapor pressure, and the form of this dependence has been determined. (auth)

25922 (EURAEC-1038) INFLUENCE OF SURFACE TREATMENT ON THE CORROSION OF CARBON AND STAINLESS STEELS IN HIGH-TEMPERATURE WATER AND STEAM. PART I. RESULTS OF THE AUTOCLAVE TESTS. Special Report No. 1. M. Warzee, J. Hennaut, M. Maurice, J. Waty (Société d'Études, de Recherches et d'Applications pour l'Industrie, Brussels); and Ph. Berge (European Atomic Energy Community). Apr. 10, 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract 089-62-7-RD B. 48p. (A translation)

The object of the study is to verify the effective character of the surface state influence. The basic materials used in the tests were a grade of 18/10 austenitic stainless steel, with 0.04% carbon (AISI 304), and a grade of low-alloy steel used in boiler making. Four completely different surface states were compared: machined with a milling tool, ground, mechanically polished up to grade 600, and electrolytically polished in an aceto-perchloric bath. The influence of the surface state was studied using static tests in autoclaves containing water at 300°C and steam at 400°C (200 kg/cm^2). The tests lasted for 300, 1000, and 2000 hours. In all cases examined, an influence significant of the surface state was demonstrated. The essential point relative to this influence is its differentiated character depending on the kind of steel and the oxidation conditions. Insofar as the low-alloy steel is concerned, the surface state reacts similarly in water at 300°C and in steam at 400°C. Electrolytic polishing enables the corrosion rate to be lowered by a factor of about 2 by comparison with the ground and mechanically polished states. On the other hand, rough machining increases the corrosion rate by 20% or so by comparison with a fine mechanical treatment. Tests carried out on a grade of 18/10 austenitic stainless steel call for quite different conclusions. Though electrolytical polishing makes a big improvement in water at 300°C, this surface treatment is harmful in steam at 400°C. The corrosion rate in water at 300°C for electrolytically polished samples is three to four times lower than that of the specimens subjected to mechanical treatments. On the other hand, in steam at 400°C, the electrolytically polished specimens show about 50% higher corrosion. These preliminary tests were carried out at temperatures of 300° and 400°C in connection with the use of steels in boiling-water and pressurized-water reactors. They show the interest of the "surface state" factor, the influence of which merits further investigation in a larger temperature range, including steam superheated above 400°C. A subsequent report will give the results of this extension of the study, which has already enabled the extremely large influence of the surface state on the corrosion of stainless steel in superheated steam at 500°C to be demonstrated. The results obtained at 400°C showed the probable benefit conferred by mechanical surface treatments. The results at 500°C not only confirm this benefit, but also considerably extend it. Other subsequent reports will deal with various aspects of the study, principally the description of a loop for dynamic corrosion tests in pressurized water and the use of a special technique for evaluating the corrosion of steels in water and in steam; this is the so-called hydrogen diffusion measurement evaluation. A report will be devoted to the results of the micrographical examinations of the samples of steels corroded in water and in steam. (auth)

25923 GRAPHITE OXIDATION AT LOW TEMPERATURE. Edward Effron and H. E. Hoelscher (Johns Hopkins Univ., Baltimore). A.I.Ch.E. (Am. Inst. Chem. Engrs.) J., 10: 388-92(May 1964).

Graphite oxidation at 420 to 530°C was found to yield a reaction order between ½ and 1, and an activation energy of 35 to 40 kcal/g mole. With ¼-in. rods used, kinetic data were only slightly influenced by diffusion effects at the upper temperature limit. Particle size was found to have an important influence on the relative amounts of carbon dioxide and carbon monoxide produced. A reaction mechanism is proposed to explain the data and the bulk of literature results obtained below 600°C. The mechanism postulates the primary formation of carbon monoxide and carbon dioxide at the graphite surface followed by oxygen exchange between the desorbed carbon monoxide molecule with the surface complex to yield additional carbon dioxide. (P.C.H.)

25924 CORROSION PREVENTION IN THE NUCLEAR POWER INDUSTRY IN THE UNITED KINGDOM. C. W. Brewer. Australasian Corrosion Eng., 7: 9-17(July 1963).

The nature of nuclear fission reactions and corrosion problems involved in the gas-cooled graphite-moderated, pressurized-water, and fast neutron breeder reactors are discussed. (TCO)

25925 INFRA-RED INTERFERENCE MEASUREMENTS ON OXIDE FILMS ON ZIRCONIUM. N. J. Wilkins (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Corrosion Sci., 4: 17-24(Mar. 1964).

Color/weight-gain charts for anodic oxide films on Zr were normally confined to the range 0.25–1μ. It is shown that the range can be extended to 15μ. The modifications required to allow for absorption, and related changes in refractive index of the oxide, are discussed; and data from oxide films grown on single crystals of Zr in steam at 500°C, 1 atm, are interpreted. (P.C.H.)

25926 RADIOCHEMICAL STUDY ON THE CORROSION OF IRON. K. H. Lieser, O. Kalvenes, and S. Compostella (Technische Hochschule, Darmstadt, Ger.). Corrosion Sci., 4: 51-61(Mar. 1964). (In German)

The corrosion of Fe was studied qualitatively and quantitatively at the very early stages using ^{59}Fe as a tracer. Autoradiography in particular gave a very instructive picture of the corrosion phenomena. The distribution of the activity on the surface of the Fe plates was measured by scanning with a slit. The results of the experiments in O-containing and in O-free solutions are in very good agreement with a corrosion mechanism previously proposed. By excluding O completely, no corrosion could be detected. Heterogeneous exchange of Fe ions between the surface of the metal and the solutions did not take place in noticeable amounts. Point deposition of Fe was observed on Fe plates containing H. This phenomenon is interpreted as a modification of pitting. (auth)

25927 RADIOCHEMICAL STUDY ON THE CORROSION OF ZINC AND THE HETEROGENEOUS ISOTOPIC EXCHANGE BETWEEN ZINC AND ZINC SOLUTIONS. K. H. Lieser and K. Bachmann (Technische Hochschule, Darmstadt, Ger.). Corrosion Sci., 4: 63-80(Mar. 1964). (In German)

The heterogeneous exchange of Zn ions between Zn plates and solutions was studied with the complete exclusion of O. In the presence of O the corrsion in different electrolytes was investigated. Plates of very pure Zn were used and ^{65}Zn and ^{59}Fe were used as tracers, respectively. The investigations showed that no heterogeneous exchange took place under the experimental conditions (room temperature) within the error of the measurements. (< 0.1 surface layers were engaged in the exchange reaction.) The phenomena previously described as heterogeneous exchange were due to corrosion or adsorption. The corrosion was studied in the very early stages using autoradiography, at a time when corrosion products can be found neither by chemical nor by x-ray methods. The labeled ions are engaged in forming the corrosion products; ^{59}Fe is engaged in forming the cathodic corrosion product only. Heterogeneous exchange with the corrosion products does not take place to a measurable amount. The different behavior of Zn in NaCl, Na_2SO_4, and $NaNO_3$ solutions is explained essentially by the different properties of the hydroxy salts of Zn. Pitting was already observed in water after 1 to 2 hr. Lower corrosion rates and uniform distribution of activity was found in the presence of inhibitors; insufficient concentrations of inhibitors lead to pitting. (auth)

25928 HIGH-TEMPERATURE OXIDATION OF MOLYBDENUM SILICIDES. V. E. Ivanov, E. P. Nechiporenko, V. I. Zmii, P. I. Glushko, O. M. Aleksandrov, and V. I. Dorokhov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Fiz. Metal. i Metalloved., 17: 142-4(Jan. 1964). (In Russian)

Oxidation of $MoSi_2$ in air was studied during 10 hours of intermittent heating from 1400 to 1700°C. With increased time and temperature the oxidation increased according to a parabolic law. X-ray studies indicated the presence of an amorphous vitreous oxide film which, in addition to SiO_2, contains unidentified inclusions. The activation energy of oxidation at 900 to 1200°C is 39 kcal/mole and at 1400 to 1700°C, 79 kcal/mole, indicating the presence of some protective film preventing rapid oxidation at high temperatures. (R.V.J.)

25929 ANODIC OXIDATION OF VANADIUM AND COLUMBIUM. A. Ya. Shatalov, T. P. Bondareva, and L. E. Tsygankova. Izv. Vysshykh Uchebn. Zavedenii, Khim. i Khim Tekhnol., 6: 631-6(1963). (In Russian)

The passivation potential curves and rate of anodic oxidation of V and Nb in NaOH, H_2SO_4, HCl, HNO_3 and H_3PO_4 electrolytes at room temperature as affected by pH and current densities were determined. (Rev. Metal Lit., 21: No. 4, April 1964)

25930 ON THE OXIDATION OF YTTRIUM. H. J. Borchardt (E. I. du Pont de Nemours and Co., Wilmington, Del.). J. Inorg. Nucl. Chem., 26: 711-19(May 1964).

The air oxidation of Y was studied at 900 and 1400°C. Yttrium was found to have O solubilities corresponding to 5.1 and 28% internal oxidation of the metal at 900 and 1400°C, respectively. The rate of solution is very rapid and is the dominating process during initial stages of oxidation. Oxygen diffusion coefficients in Y metal have the following approximate values: 1.3×10^{-6} (900°C), 2×10^{-5} (1400°C) cm^2/sec. As saturation is approached, oxidation continues via the formation of surface oxide, the diffusion of oxygen through Y_2O_3 being rate limiting. Parabolic rate law constants yield an activation energy and pre-exponential terms as follows: $k = 1.43 \times 10^{-3} \exp(-44{,}500/RT) g^2 cm^{-4} sec^{-1}$. Yttrium is unique in being able to maintain a stable protective oxide scale to thicknesses as high as 100 μ. This results in high-temperature oxidation resistance unparalleled by any other elemental base metal. (auth)

25931 ALUMINUM–SILICON MATERIALS WITH GOOD CORROSION STABILITY IN HIGH-TEMPERATURE WATER. Harald Spindler (Zentralinstitut für Kernphysik, Rossendorf, Ger.). J. Nucl. Mater., 11: 203-11(Feb.-Mar. 1964). (In German)

The corrosion behavior of Al–Si–Ni alloys containing 7 to 13 wt % Si in very pure water at 300 and 350°C was surveyed for different states of the material and various experimental conditions, and certain mechanical properties are reported. Because of the unsatisfactory hot strength of these alloys, experiments were extended to sintered Al powder alloyed with Si and Ni; the resulting materials, combining good corrosion resistance with good hot strength, possess advantages in comparison with Al-base alloys as hitherto used for water-cooled reactors. (P.C.H.)

25932 KINETIC ANISOTROPY IN THE OXIDATION OF GRAPHITE. J. M. Thomas and K. M. Jones (Univ. Coll. of North Wales, Bangor, Caernarvonshire, Eng.). J. Nucl. Mater., 11: 236-9(Feb.-Mar. 1964).

A simple interferometric technique was used that enables the depths of etch pits produced on graphite single crystals by oxygen and by nitric oxide to be measured. This information leads directly to $R_{(a/c)}$, the ratio of oxidation rates along and perpendicular to the basal plane: this ratio is an index of the kinetic anisotropy. By combining the value of the ratio with previously determined values for the rate of oxidation along $\langle 11\bar{2}0 \rangle$, estimates of the absolute rate

of reaction in the c-direction were made. For the temperature range studied (800 to 910°C), the kinetic anisotropy did not alter significantly with temperature. The value of $R_{(a/c)}$ at 800°C, in oxygen, is 26, which means that, at the etch pits, the rate of oxidation per cm^2 of basal surface is about 2×10^{-6} g/sec. (P.C.H.)

25933 LITHIUM PROTECTIVE GAS GENERATOR. G. Meyer (Eidgenössische Technische Hochschule, Zurich). Metall, 18: 468-9(May 1964). (In German)

The formation of an oxide film on the surface of a metal during molding and heat treatments was previously found to be prevented by preheating in a lithium salt vapor. A lithium protective-gas generator was developed, which consisted of a vapor generator and a control chest. Operation of the generator and examples of its use are discussed. (M.C.G.)

25934 HOW TANTALUM "RUSTS." New Scientist, 20: 676(Dec. 12, 1963).

Studies were made on the oxidation of Ta at various high temperatures. The oxides formed, namely TaO_y, TaO_2, TaO, and Ta_2O_5, do not exist as continuous surface films but rather as platelets or porous scale. The oxygen also penetrates deeply into the metal reducing its mechanical strengths. (Rev. Metal Lit., 21: No. 4, April 1964)

25935 OXIDATION KINETICS OF TANTALUM IN CARBON DIOXIDE. K. J. Richards (Aerospace Research Labs., Wright-Patterson AFB, Ohio) and M. E. Wadsworth. Trans. Met. Soc. AIME, 230: 33-8(Feb. 1964).

The oxidation rates of Ta in various partial pressures of carbon dioxide in the temperature range 700 to 950°C were measured using a thermogravimetric balance. Oxidation involved a surface-controlled reaction associated with the formation of a nonprotective layer of Ta_2O_5. Below about 720°C, there was a change in the rate-determining mechanism, and above 830°C the linear rate was preceded by a complex region of nonlinear oxidation behavior. The linear oxidation of tantalum has been explained quantitatively in terms of carbon dioxide adsorption, followed by a rate-controlling surface reaction. The initial adsorption has been expressed both as an equilibrium process and as a steady-state reaction. The enthalpy for chemisorption of CO_2 was determined to be −17.3 kcal per mole. The surface-controlled reaction had an activation enthalpy of 40.4 kcal per mole. (auth)

25936 OXIDATION OF NIOBIUM AND ITS ALLOYS. R. A. Ul'yanov and N. D. Tarasov. Tsvetn. Metal., No. 4, 70-2(Apr. 1964). (In Russian)

Studies of the effects of various alloying metals on the rate of Nb oxidation at 1100°C showed that Mo, Ti, and Cr considerably reduced the oxidation rate; Ta, Re, and Pd also slowed the oxidation, while Zr, Ir, and La accelerated oxidation. A somewhat reduced oxidation was found with B, Be, and Si. (R.V.J.)

25937 THE BEHAVIOUR OF MATERIALS IN LIQUID SODIUM. C. Tyzack (United Kingdom Atomic Energy Authority, Culcheth, Lanes, Eng.). p.239-65 of "Advances in Materials. Inter-Disciplinary Symposium, Third and Fourth Sessions, 7 April, 1964." London, The Institution of Chemical Engineers, 1964.

Experimentation has shown that the behavior of materials in sodium at high temperatures is largely conditioned by their interaction with impurities in the liquid metal such as oxygen, nitrogen, carbon, and hydrogen. It is beyond the scope of this paper to consider the effects of all these impurities on the corrosion behavior and mechanical properties of materials of interest in sodium technology, and attention is confined to discussing the effects of oxygen impurities on corrosion behavior of selected metals. The behavior of a particular metal in sodium is largely determined by the relative thermodynamic stability of its oxide at the temperature of interest in relation to that of sodium oxide, or sodium containing sodium oxide at less than unit activity. Three types of behavior were distinguished. If the metal oxide is less stable than sodium oxide then any room temperature oxide existing on the metal will be reduced and the subsequent behavior of the metal surface wetted by sodium will depend on solution processes of which two types were distinguished: a process where the slowest step is dissolution at the solid/liquid interface and a process where diffusion of solute across a boundary layer is rate controlling. If, on the other hand, the oxide of the metal exposed in sodium is of much greater stability than sodium oxide then there seems to be a tendency for simple oxides to be formed similar to those formed in the gas phase under oxidizing conditions. The detailed behavior may, however, depend on the mechanical stability of the oxide film in the liquid metal under erosive conditions. The third class of behavior that was observed is that where the oxide of the metal exposed in sodium is of comparable thermodynamic stability to sodium oxide, where there is a tendency for complex oxides containing sodium and the metal in question to be formed. Niobium is a good example of this, and the complex oxide formed appears to have poor protective properties, as the bulk of the film is lost into the sodium stream under dynamic conditions. (auth)

Fabrication

25938 (AD-439498) DEVELOPMENT OF VERY HIGH-STRENGTH BERYLLIUM WIRE. Bimonthly Report No. 2, February 6–April 6, 1964. Technical Report No. 351-243. E. A. Murphy and R. G. O'Rourke (Brush Beryllium Co., Cleveland). Contract NOw-64-0162-c. 14p.

The results of work directed toward development of a process to produce fine, high-strength beryllium wire are described. The extrusion data for −10 +1 (IP) and 0.4% Fe alloy are listed, along with the chemistry of the −10 +1 (IP) material. Warm drawing results of the −74 +1, −20 +1, −10 +1, and −5 +1 materials are discussed. (auth)

25939 (ANL-6868(p.201-18)) DEVELOPMENT OF FABRICATION METHODS. (Argonne National Lab., Ill.).

The fabrication of tubes and foils for use as reactor fuel element components is evaluated. The design and operation of electric-arc and electron-beam furnaces are summarized. Fuel plate fabrication for the ZPR-VI critical assembly is described. (N.W.R.)

25940 (BMI-X-294) FABRICATION OF URANIUM AND URANIUM-BASE ALLOY TUBES AND RODS. Final Report. E. G. Smith, Jr. (Battelle Memorial Inst., Columbus, Ohio). June 9, 1964. For National Lead Co. of Ohio, Cincinnati. Contract [W-7405-eng-92]. 38p.

A rolling study was made in which uranium and uranium-base alloys were fabricated using a nomical 5 percent OD reduction per pass rolling schedule. The materials rolled were in the form of tubes and rods with the tubes supplied with 5 ratios of wall-thickness-to-diameter. All materials were either in the as-extruded or beta-heat-treated condi-

tion. A 16 × 24-inch two-high rolling mill was used to fabricate the material at 1150°F using two sets of rolls. The necessary instrumentation was assembled to record values of roll separation force, mill power input, time of rolling, and specimen temperature for each specimen and pass. Measurements were made from samples of the tube and rod specimens at intervals during the rolling schedule. The data generated from this study are tabulated for each specimen and pass number. These results indicate the beta-heat-treated uranium material in either tube or rod form is easier to fabricate than the as-extruded material while the uranium alloy containing additions of iron, silicon, and aluminum is the most difficult. For tubes with the lower initial wall-thickness-to-diameter ratios, a definite wall thickneing trend occurs that is not observed for tubes with higher ratios. (auth)

25941 (DMIC-197) CRACKING IN HIGH-STRENGTH STEEL WELDMENTS—A CRITICAL REVIEW. P. A. Kammer, K. Masubuchi, and R. E. Monroe (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Feb. 7, 1964. 117p. (AD-438432)

The major aspects of the entire field of steel weldment cracking are reviewed. The effects of cracks on weldment properties are considered principally from a theoretical viewpoint. A brief review is presented of the work of Griffith, Irwin, and Orowan on brittle fracture and some of the experimental data available on the effects of weld flaws on mechanical properties are included. The principal theories of both hot and cold cracking are presented and the factors influencing cracking are discussed. The hot-cracking theories reviewed are: the shrinkage-brittleness theory of Pumphrey, Jennings, Medovar, Bochvar, and others; the strain theory of Pellini; Borland's generalized theory; and Movchan's polygonization theory of hot cracking. Since cold cracking is usually associated with hydrogen embrittlement, the planar pressure theory and its modifications, the adsorption theory of Petch et al., and the Troiano theory of hydrogen embrittlement are reviewed. The factors influencing cracking are arbitrarily divided into mechanical, thermal, metallurgical, and service conditions. The control of cracking is discussed. Both material selection and welding techniques (such as preheat, stress-relief heat treatment, and peening) are discussed. A discussion of indirect and direct test methods used to study weldment cracking is included. (auth)

25942 (GEAP-4556) DESIGN AND FABRICATION OF FUEL RODS CONTAINING SINTERED UO_2 EXTRUSION—ASSEMBLY 11L. F. H. Megerth (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Feb. 1964. Contract AT(04-3)-189. 66p.

A fuel rod assembly was designed and fabricated to evaluate the irradiation performance of sintered UO_2 extrusions. The extrusions were produced by the following steps: mixing UO_2 with binders or plasticizers and water, extruding into cylindrical rods, drying, pressing, sintering in a cracked ammonia atmosphere, and grinding to the specified diameter. The following characteristics of the various extrusions were determined: straightness, end squareness, surface quality, density, and microstructure. The material used to clad the extrusions was Type 304 stainless steel tubing. Twelve extruded UO_2 fuel rods and 4 pellet-filled rods for comparison were assembled in a fuel bundle for insertion in the VBWR. (M.C.G.)

25943 (HW-30116) THE HYDROGEN CONTENT OF FABRICATED URANIUM. W. E. Ray and H. C. Bowen (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 30, 1953. Contract W-31-109-eng-52. 22p.

Studies were made of the complete extraction of hydrogen from uranium in a vacuum at temperatures between 600 and 750°C. It was found that the amount of hydrogen added to uranium during the beta heat-treatment procedure is small when compared to the volume contained in as-rolled metal. It was determined, however, that the added hydrogen is contained in the outer 0.20 inches of the slug. The location of this gas is perhaps more important than the actual amount involved. The manner in which hydrogen content varied along the length of one rod was determined. The volumes of hydrogen added at several steps in the beta heat-treating procedure are presented. The effect on hydrogen content of altering heating and etching-methods was examined. It was ascertained that the hydrogen contents of uranium powder metallurgy compacts are generally lower than those of standard production pieces. (auth)

25944 (N63-14854) TUNGSTEN SHEET ROLLING PROGRAM. Final Report, June 1, 1960–March 1, 1963. George C. Bodine, Jr. (Fansteel Metallurgical Corp., North Chicago, Ill.). Mar. 1, 1963. Contract NOw-60-0621-c. 93p.

Powder metallurgy tungsten plate and sheet has been produced in quantity according to optimum processing procedures developed in the pilot powder and sheet phases. Inspection and test results show the material to be of good quality but not as consistent as full-scale pilot material. Examination of all program data indicates that extremely close controls are an absolute prerequisite for the production of consistent and reliable powder metallurgy tungsten plate and sheet. This report contains a complete description of the finished articles, and recommendations. (auth)

25945 (EURAEC-1039) ELECTROSLAG WELDING OF REACTOR STEELS. Quarterly Technical Report No. 11, January 1–March 31, 1963. (Schweisstechnische Lehr- und Versuchsanstalt, Duisburg, Germany). Apr. 21, 1964. Work Performed under United States–Euratom Joint Research and Development Program. 7p. (A translation)

Techniques for welding thick ASTM A302B steel and chromium-molybdenum steel are discussed with respect to preparatory work required. (N.W.R.)

25946 (RSIC-177) DEVELOPMENT OF A HIGH-STRENGTH STRESS-CORROSION-RESISTANT ALLOY WITH AN AlZnMg BASE. PART II. W. Rosenkrang. Translated from Aluminium, 39: 741-52(1963). 22p.

The stress-corrosion behavior of extruded sections of high-strength Al–Zn–Mg–Cu alloys in an acid corrosion medium (0.01N HCl) and in the atmosphere was studied. There were found to exist in the fine-grain zone at the edge a considerably smaller dependence of the life duration of the sample on direction than in the nuclear structures stressed with the press effect. The durability of the fork samples in the vertical direction was very small. The addition of chromium, which otherwise has a favorable effect on the stress-corrosion behavior, had no noteworthy improving effect. It was found that residues of an undissolved Cu-containing phase cover and nearly inactivate the chromium effect while $FeAl_3$ bands have a surprisingly small effect. By adjustment of the Zn, Mg, and Cu components of the alloy as well as by means of homogenization of the casting, which brings the copper present to complete solution, the chromium effect may be made to exert its full activity also in the vertical direction of the nuclear structure; in these measures the magnitude of the magne-

sium content, which has a deleterious effect on the solubility of Cu, acquired greater significance. More certainty was assured when a part of the copper was replaced with silver, since the solubility of silver is not reduced as strongly by magnesium as that of copper. Under the conditions described the problem of stress corrosion of alloys of the Al–Zn–Mg type, when using age-hardening temperatures between 140 to 170°C, were considered almost solved for the critical vertical direction. The intentional and unintentional plastic deformtaions in the age-hardened state also must be considered, but are thought to be less important. In addition to the favorable effect on the stress-corrosion behavior of the alloy, produced by the addition of silver, it has two other advantages. It markedly retards the lowering of the static strength values occurring with increasing age-hardening temperatures, when the usual periods of storage at room temperature are employed between quenching and age-hardening, and thus contributes to the elimination of stress corrosion by making it possible to use higher age-hardening temperatures. The effects of the duration of storing at room temperature on the values attainable through age hardening, present in silver-free Al–Zn–Mg–Cu alloys, are also eliminated. This means that the periods of storage at room temperature may be abolished, and that dispersion effects brought about as a function of the length of age-hardening due to the overlapping of different age-hardening mechanisms, are also prevented. (auth)

25947 THE TAMING OF PLUTONIUM. Atomics, 17: No. 3, 15-18(May-June 1964).

The fabrication, performance, and economics of plutonium fuel elements are discussed. Information is included on development, chemical processing, physics aspects, radiological control experience, and economics. (P.C.H.)

25948 SPECIAL APPLICATIONS OF ARGON ARC WELDING METHOD AT THE PETTEN REACTOR CENTRUM NEDERLAND. Ir. E. Lijbrink and J. H. Jaspers. Atoomenergie Haar Toepassingen, 6: 45-51(Mar. 1964). (In Dutch)

In the manufacture of irradiation capsules for experiments within the framework of the NERO reactor development program, the most refined welding techniques must be used in order to satisfy the experimental conditions given. A description is given of the manufacture of some capsule types by welding with a nonmelting tungsten electrode. The apparatus used is also described. Capsules of Zircaloy, stainless steel, and aluminum were cited to indicate the range of techniques. (tr-auth)

25949 PRODUCTION PROBLEMS ASSOCIATED WITH THE ELEMENT BERYLLIUM. THE FIFTH ROBERT HORNE MEMORIAL LECTURE OF THE SOCIETY OF CHEMICAL INDUSTRY. P. H. Evans (Imperial Smelting Corp., Avonmouth, Bristol, Eng.). Chem. Ind. (London), No. 16: 632-44(Apr. 18, 1964).

Advances in Be technology are reviewed with special attention to chemical processes and Be oxide fabrication. Properties and toxicity of Be are discussed. (P.C.H.)

25950 TUNGSTEN GRANULES MAKE STRONG SHEET. Daniel J. Maykuth, John L. Ratliff, and Horace R. Ogden (Battelle Memorial Inst., Columbus, Ohio). Metal Progr., 85: No. 6, 109-12(June 1964).

Granular tungsten is produced by reducing tungsten hexafluoride with hydrogen. The resulting powder consists of spheres 200 to 600 μ in dia., that can be bonded and rolled into strong, durable sheet that resists high temperatures. The granules contain less than 20 ppm Mo; less than 10 ppm N, C, Al, Fe, Ni, Si, and Sn; less than 5 ppm Ca, Cu, and Mg; 7 ppm O; and 1 ppm H. The method for fabricating the sheet and its mechanical properties are discussed. (P.C.H.)

25951 EXPLANATION OF SINTERING PROCESSES FOR THORIUM POWDER COMPACTS. W. Borchert and E. Rieger (Technische Hochschule, Munich). Metall, 18: 446-50(May 1964). (In German)

With a high-temperature dilatometer the isotherm sintering shrinkage of thorium powder compacts in an argon atmosphere perpendicular to the press direction was investigated in the temperature range from 830 to 1420°C. The course of the shrinkage in a definite period of time could be approximated in sections by time-power laws, which could be interpreted on the basis of the thermal activation energy with expressed sintering mechanisms. As a probable mechanism for the first sintering phase, plastic flow in the form of high-temperature creep was obtained. For the second sintering phase, volume diffusion by decomposition of oxide and nitride layers on the surface of the grains of strongly deformed lattices with many vacancies was found. Volume diffusion in a crystal lattice in thermal equilibrium and grain-boundary diffusion were mechanisms for the third and fourth time-power laws. (tr-auth)

25952 MPEP—THE METALWORKING PROCESSES AND EQUIPMENT PROGRAM. T. F. Kearns (Bureau of Naval Weapons, Washington, D. C.). Metals Eng. Quart., 4: No. 2, 1-11(May 1964).

An inter-agency government sponsored research and development program on metal deformation processing is described. Significant developments which can influence metal deformation processing are presented. The dramatic reduction in yield stress of metals observed when ultrasonic energy is super-imposed on applied loads is discussed, as are applications of this phenomenon to several deformation processes. Results of testing of brittle metals such as tungsten, molybdenum, and beryllium under an environment of high hydrostatic pressure showed that impressive increases in ductility for these metals can be obtained, and tend to indicate that utilization of high hydrostatic pressure for metal processing may have distinct potentiality. Observations on the effects of orientation and texture of crystals, strain rate and temperature, and modes of deformation during metalworking reveal that consideration must be given to these factors for most efficient processing of metals such as high-strength steels, superalloys, refractory metals, and beryllium. (auth)

25953 METALLURGICAL BONDING OF DISSIMILAR METALS BY CO-EXTRUSION. Paul Loewenstein and Wilson B. Tuffin (Nuclear Metals, Inc., Concord, Mass.). Metals Eng. Quart., 4: No. 2, 26-31(May 1964).

The co-extrusion process lends itself to the production of high quality metallurgically bonded shapes of several metals. Mechanical and metallurgical aspects of bonding are described; and the importance of bond layer thickness, when brittle compounds form, is discussed. Specific illustrations are given of applications of the process to rods, shapes, tubes, and tubular transition joints. (auth)

25954 CASTING TUNGSTEN AND TUNGSTEN–MOLYBDENUM ALLOYS. Frank Vandenburgh and Glenn Chaffin. Mod. Castings, 45: 25-7(Jan. 1964).

A description is given of the centrifugal casting method for the production of semifinished shapes of W and W–Mo alloys. Data on the mechanical and physical properties and

the machinability of the alloys are tabulated. (Rev. Metal Lit., 21: No. 4, April 1964)

25955 NEW TRENDS IN METAL WORKING. H. Ll. D. Pugh and M. T. Watkins (National Engineering Lab., Glasgow). p.123-59 of "Advances in Materials. Inter-Disciplinary Symposium, Fifth and Sixth Sessions, 8 April, 1964." London, The Institution of Chemical Engineers, 1964.

Among the new processes that are being developed is the application of high hydrostatic pressures to support deforming materials. A description is given of the work that was carried out on the use of a high pressure liquid to effect the extrusion of a range of materials varying from soft materials such as aluminum up to high strength materials. Extrusion of rounds, complex sections and tubes can be effected in this manner. The potential of this method as an alternative to wire drawing is also discussed. There is considerable current interest for many reasons in various materials all of which are brittle. A method is discussed in which the product emerges into a pressurized liquid whereby successful cold extrusions of brittle materials can be effected. During the last ten years there was a marked increase in the application of high rate methods in the working of metals in such operations as forming, shaping, forging, extrusion, welding, compacting, etc. In such methods energy derived from chemical explosives, high voltage discharges, electro-magnetic fields or fast moving masses is released rapidly and applied over a relatively short interval of time. Each new process has its characteristic features and a particularly advantageous field of application which are briefly discussed. (auth)

25956 IMPROVEMENTS RELATING TO METHODS OF MAKING NEUTRON-ABSORBING DEVICES. John Ashby (to Talbot-Stead Tube Co. Ltd.). British Patent 958,267. May 21, 1964. Filed Oct. 17, 1961.

A method is given for making a neutron-absorbing composite tube. The method comprises forming a plurality of separate rings by compressing and sintering a neutron-absorbing material (e.g., boron carbide in a metal matrix), inserting the rings into the annulus between two concentric tubes (e.g., steel), and passing the assembly of rings and tubes through a die over a mandrel to produce the composite tube. The rings may be plated before being inserted into the tubes to inhibit boron migration. (D.L.C.)

25957 GRAPHITE STRUCTURE. (to Ford Motor Co., Ltd.). British Patent 958,376. May 21, 1964. Priority date Sept. 14, 1959, United States.

A process is given for impregnating a carbon mass to render it less permeable, improve its properties, and increase its joining ability. The process comprises contacting the carbon mass with molten Fe, Co, Ni or alloy thereof under such conditions that the angle of contact between the molten metal and carbon is less than 90°. Data on the effects of carbon content on the diffusion of Fe, Co, and Ni into carbon are tabulated which show that as the carbon content in the molten metal increases, the contact angle increases and the impregnation rate decreases. The carbon may be coated with a thin coating of Cu, Ag, Au, or an alloy thereof prior to impregnation. (D.L.C.)

25958 IMPROVEMENTS IN OR RELATING TO THE MANUFACTURE OF NEUTRON-ABSORBING MATERIALS. Peter William McMillan, Brian Purdam Hodgson, and Elizabeth Mary Souch (to English Electric Co., Ltd.). British Patent 958,790. May 27, 1964. Filed Sept. 17, 1959.

A method is given for manufacturing refractory materials which absorb slow neutrons. The method comprises forming a glass which contains a major proportion of oxides with a large neutron cross section ($>5 \times 10^{24}$ barns/g at 0 to 2.0 ev), shaping the glass, and devitrifying it to form a glass-ceramic material which is more refractory than the original glass. The method is described with reference to silicate and borate glasses, and the oxides with large cross sections are CdO and In_2O_3. (D.L.C.)

25959 IMPROVEMENTS IN OR RELATING TO PROCESSES FOR EFFECTING A WELD BETWEEN THE ADJOINING ENDS OF TWO MEMBERS LYING SIDE BY SIDE AND TO WELDS MADE BY SUCH PROCESSES. Alan Frederick Taylor and James Thomas Stockdale (to United Kingdom Atomic Energy Authority). British Patent 960,104. June 10, 1964. Filed Aug. 4, 1960.

A process is given for welding the end cap to the sheath of a fuel element. The process comprises forming a U-shaped weld groove in the adjoining ends of the sheath and the skirt of the end cap and making an inert-gas weld with the tip of the electrode below the top of the U-groove. The sheath and end cap may be made of Magnox or Mg ZA alloy. A welding machine and procedures are described for carrying out the process. (D.L.C.)

25960 IMPROVEMENTS IN OR RELATING TO THE FABRICATION OF FUEL ELEMENTS AND ELEMENTS SO PRODUCED. (to General Dynamics Corp.). British Patent 960,352. June 10, 1964. Priority date Feb. 8, 1962, United States.

A method for fabricating a fuel body containing a fissionable fuel and a metal hydride moderator is given which eliminates the necessity for machining the slug or drawing the canned slug in order to obtain a tight fit between the slug and the can. The method comprises forming a solid body from a mixture of fuel (^{235}U) and a hydride-forming metal (Zr), enclosing the body within a metal sheath (stainless steel) which is permeable to hydrogen at 700 to 900°C, and passing hydrogen through the sheath at this temperature to form a hydride. Several examples of the method are given. (D.L.C.)

25961 METHOD AND APPARATUS FOR SEALING TUBES. Cecil C. Stone (to U. S. Atomic Energy Commission). U. S. Patent 3,135,856. June 2, 1964.

A method and apparatus are described for welding tubes to a tube sheet as in a heat exchanger. The welding gun is held in a harness which is kept oriented by two ropes leading to a common counterweight. The gun is inserted into a tube in the tube sheet, the welding current is turned on, and the entire tube sheet makes a full turn. (AEC)

25962 CLADDING OF NUCLEAR FUEL ELEMENTS. Frank B. Quinlan and Robert G. Wheeler (to U. S. Atomic Energy Commission). U. S. Patent 3,136,051. June 9, 1964.

A process is given for bonding uranium, zirconium, or their alloys to ferrous metal. A molybdenum barrier is interposed; the assembly is encased in an evacuated and sealed container, forged at 600 to 1000°C to half the thickness, soaked at the same temperature for two hours, cross-rolled to 20% of the original thickness, again soaked at 600 to 1000°C, and cooled. The container is then removed. (AEC)

25963 PRODUCTION OF URANIUM–CARBON ALLOYS. Jack Williams and Michael Colin Regan (to United

Kingdom Atomic Energy Authority). U. S. Patent 3,136,629. June 9, 1964. Priority date Sept. 8, 1959, Great Britain.

A method is given for producing U–C alloys with maximum density. The method comprises forming a mixture of U (with or without Pu), C, and Fe in the form of UFe_2; cold-compacting the mixture; and sintering in a furnace heated to a temperature of 1000 to 1125°C. Maximum density is obtained when the Fe content of the mixture is ~3% (10% UFe_2) and when the C content of the mixture is the stoichiometric amount required to form UC with the uncombined U. Several examples of the method are given. (D.L.C.)

25964 SEAL FOR MOVING ELECTRON BEAM COLUMN. Edward W. Radtke (to United Aircraft Corp.). U. S. Patent 3,136,883. June 9, 1964. Filed Apr. 2, 1962.

An apparatus is designed for working large pieces of equipment of materials with an electron beam. The apparatus comprises means for creating a vacuum about a region of the piece to be worked and having an opening in its top, means for supporting the beam source in alignment with the opening, and means for sealably moving the source along the opening so that all of the opening is covered by the source and supporting means. (D.L.C.)

25965 CERAMIC PRODUCT COMPRISING SINTERED BERYLLIA AND BENTONITE AND METHOD. John F. Quirk and Fred H. Lofftus (to U. S. Atomic Energy Commission). U. S. Patent 3,137,657.

A method is described for mitigating and avoiding structural damage to beryllia compacts when subjected to neutron irradiation, especially cracking attributed to helium generation in situ. By admixing bentonite with beryllia particles, more particularly bentonite having a substantially smaller particle size than that of the beryllia, and thereupon compacting and sintering, a ceramic product is afforded of enhanced resistance to such radiation damage. The benefit is ascribed to the service of a resulting network of sintered bentonite in the intergranular interstices of the beryllia in affording pathways for more ready diffusion of the helium from the mass. (AEC)

Properties and Structure

Refer also to abstracts 25269, 25421, 26113, and 26534.

25966 (ANL-6868(p.120-32)) DEVELOPMENT OF ALLOY FUELS AND JACKET MATERIALS. (Argonne National Lab., Ill.).

The crystal structure and phase studies of plutonium–thorium–uranium alloys are investigated along with the properties of the individual components and binary alloys of the system. Creep and tensile properties of niobium–zirconium alloys are given along with the tensile properties of titanium–vanadium alloys at room temperature to 950°C. (N.W.R.)

25967 (ANL-6868(p.231-3)) METALLURGY OF URANIUM. (Argonne National Lab., Ill.).

The elastic moduli of monocrystals of alpha uranium and zirconium to 1200°K are evaluated. (N.W.R.)

25968 (ANL-6868(p.267-86)) METALLURGY OF TITANIUM, ZIRCONIUM, AND HAFNIUM. (Argonne National Lab., Ill.).

The elastic properties of titanium, zirconium, and hafnium–zirconium alloys are evaluated along with the plastic deformation of hydrided zirconium. These properties are evaluated at low and high temperatures. Relations to crystal structure, phase studies, thermodynamic properties, electric conductivity, and purity are discussed. (N.W.R.)

25969 (ANL-6868(p.287-302)) DIFFUSION STUDIES. (Argonne National Lab., Ill.).

The diffusion of impurities (chromium, cobalt, copper, iron, manganese, nickel, and niobium) in gamma uranium is evaluated. The diffusion of palladium in itself, copper, and silver is analyzed. Both experimental and theoretical investigations are conducted in the diffusion of zinc in pure and zinc-doped sodium chloride monocrystals; the evaluations are studied with respect to electric conductivity, activation energy, and thermodynamic properties. (N.W.R.)

25970 (ANL-6868(p.303-25)) ALLOYING PROPERTIES. (Argonne National Lab., Ill.).

The crystal structure and phase studies of various alloys, intermetallic compounds, metals, superconductors, carbides, and rare earths are evaluated along with various thermodynamic and thermoelectric properties. (N.W.R.)

25971 (ANL-6868(p.331-7)) X-RAY AND NEUTRON DIFFRACTION STUDIES. (Argonne National Lab., Ill.).

Equipment and techniques of neutron- and x-ray-diffraction analysis are discussed. The crystal and magnetic structures of $PtMn_3$ are evaluated. The crystal structure and magnetic properties of other intermetallic compounds and solid solutions are summarized. (N.W.R.)

25972 (ASD-TDR-63-90(Vol.II)) RESEARCH AND DEVELOPMENT ON HIGH-PRESSURE HIGH-TEMPERATURE METALLURGY. J. S. Harvey, S. A. Kulin, G. Orner, and S. V. Radcliffe (ManLabs, Inc., Cambridge, Mass.). Jan. 1964. Contract AF33(657)-8764. 100p.

Techniques were developed for preparing, treating, and testing sub-size tensile and Charpy impact specimens suitable for use in high-pressure equipment. The mechanical properties of a wide variety of materials including plain carbon steels, aluminum, stainless steel, and beryllium, which were pressure-cycled at room temperature, were measured and compared to properties obtained on the same materials that were not pressure-cycled. A study was made of the effects of pressure on the mechanical properties of several steels including 4320, 4340, and H-11 austenitized normally and then tempered at pressure and temperatures in the range of 200 to 500°C. Attempts to austenitize test specimens at pressure invariably resulted in severe microcracking, which precluded measurements of tensile and fracture toughness properties. A series of high-purity iron–carbon alloys ranging from 0.12 to 1.33%C was austenitized and isothermally transformed both at one atmosphere and at 42 kilobars at selected transformation temperatures. The mechanical properties of specimens subjected to these treatments were measured. (auth)

25973 (ASD-TDR-63-605(Pt.II)) A STUDY OF THE PHYSICAL BASIS OF THE MECHANICAL PROPERTIES OF CERAMICS. Gordon E. Gross and Paul L. Gutshall (Midwest Research Inst., Kansas City, Mo.). Mar. 1964. Contract AF33(657)-8572. 35p.

Investigations of the mechanical properties of ceramics as related to their electronic structure were continued. The optical-mechanical properties of germanium were studied and experimental results are presented for internal friction and bending tests conducted in the presence of infrared irradiation. The cleavage energy of sodium chloride

is given as a function of F-center density and testing environment. The cleavage energy of sodium chloride colored by diffusion increased by two at a density of 10^{16} F-centers/cm^3, with no apparent increase in the elastic modulus. Experimental results are given for Hall coefficient measurements on beryllium. (auth)

25974 (EURAEC-1037) RESEARCH TO DETERMINE THE LONG-TERM MECHANICAL PROPERTIES OF METALS SUBJECTED TO MECHANICAL STRESS AT ELEVATED TEMPERATURES AND NEUTRON IRRADIATION. Second Special Report. W. Siegfried (Battelle Memorial Inst. International Div., Geneva). [1964]. Work Performed under United States–Euratom Joint Research and Development Program. Contract 100-62-12 RDS. 71p.

A mathematical procedure was developed, which permits determination, by means of the shape of time-to-rupture curves established for different temperatures, the proportion of the following partial mechanisms of the creep process: secondary creep; formation of fissures in the grain boundaries; and formation of a neck. Using a Cr–Mo–V steel, the enthalpy of activation as a function of temperature and the entropy of activation as a function of stress were determined for these partial processes, with the aid of the thermal analysis. On the basis of the shape of the curves obtained, the interaction between the following fundamental mechanisms of the creep process is discussed: climbing of edge-dislocations; climbing of screw-jogs; stress induced movement of vacancies in the grain boundaries; formation of fissures according to the mechanism proposed by Cottrell; formation of precipitate-free zones adjacent to the grain boundaries; and brittleness and notch-sensitivity at high temperatures. (auth)

25975 (NAEC-AML-1909) STUDY OF SIZE EFFECT IN FINE BERYLLIUM WIRE. PHASE II. Paul J. Soltis (Naval Air Engineering Center. Aeronautical Materials Lab., Philadelphia). Mar. 27, 1964. 22p.

Results of tension tests on ultrafine beryllium wire chemical-milled to less than 0.0010 in. dia. are given. A complete metallurgical analysis is given, and recommendations for future work are made due to the ductility found at the small sizes. The wire shows strength near the 200,000 psi level. (R.E.U.)

25976 (NMI-1261) FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. SURVEY OF TUNGSTEN ALLOYS CONTAINING APPROXIMATELY 25% RHENIUM. A. L. Geary (Nuclear Metals. Div. of Textron Inc., West Concord, Mass.). May 29, 1964. Contract AT(30-1)-2784. 34p.

The findings of a literature survey on the properties of rhenium alloys are reported. The survey was made as a preliminary phase of a program to develop fabrication processes for tungsten-rhenium alloy tubing; its main purpose was to assemble information that could then be used as a guide for the experimental work. Both the classified and unclassified literature were searched but no attempt was made to make an exhaustive search of the foreign literature or to gain information from workers currently investigating these alloys, other than on an informal basis. All information contained in this report has appeared in unclassified literature. This survey is complete to September 1963. (auth)

25977 (ORNL-3582(p.2-4)) ALIGNMENT OF RARE-EARTH MOMENTS IN DILUTE Pd–Fe ALLOYS. J. W. Cable, E. O. Wollan, W. C. Koehler, and H. R. Child (Oak Ridge National Lab., Tenn.).

Neutron scattering and magnetization measurements were made on the ternary alloy system $Pd_{0.98}Fe_{0.02}R.E._{0.01}$ (R.E. = La, Ce, Pr, Nd, Gd, Tb, Dy, Ho, Er, Tm, and Yb). Only partial alignment of the rare-earth moments was observed. This alignment was parallel to the Pd and Fe moments for those rare earths to the left of Gd and antiparallel for those to the right of Gd. This observation is consistent with an antiferromagnetic spin-spin interaction since, for the former, J = L – S and, for the latter, J = L + S. (auth)

25978 (ORNL-3582(p.5-6)) ANTIFERROMAGNETISM OF ORDERED Pd_3Cr. J. W. Cable, E. O. Wollan, W. C. Koehler, and H. R. Child (Oak Ridge National Lab., Tenn.).

Neutron diffraction measurements were made on Pd_3Cr to determine the type of magnetic order and the distribution of magnetic moments for this ordered alloy with the Cu_3Au type structure. The observations are best explained by an antiferromagnetic structure in which adjacent ferromagnetic (111) planes of moments are oppositely oriented. A Cr moment of $3.2\mu_B$ and a very small Pd moment are indicated. (auth)

25979 (ORNL-3582(p.7-8)) NEUTRON-DIFFRACTION INVESTIGATION OF CHROMIUM ALLOYS. Y. Hamaguchi, E. O. Wollan, and W. C. Koehler (Oak Ridge National Lab., Tenn.).

Neutron diffraction measurements on dilute Mn in Cr alloys are reported. Implications of the results to the electronic structure of chromium are indicated. (auth)

25980 (ORNL-3582(p.9-10)) THE MAGNETIC PROPERTIES OF INTRA-RARE-EARTH ALLOYS. H. R. Child, W. C. Koehler, E. O. Wollan, and J. W. Cable (Oak Ridge National Lab., Tenn.).

Selected binary intra-rare-earth alloy specimens have been examined by neutron diffraction to determine their magnetic ordering transition temperatures. (auth)

25981 (ORNL-3582(p.11-16)) SOME MAGNETIC STRUCTURE PROPERTIES OF RARE-EARTH ALLOYS. W. C. Koehler, E. O. Wollan, H. R. Child, and J. W. Cable (Oak Ridge National Lab., Tenn.).

Alloys of the heavy rare-earth metals with yttrium have been studied to investigate the mechanism of the indirect exchange interaction in the rare-earth metals. Results for R-Y with R = Tb, Dy, Ho, Er, and Tm are reported. (auth)

25982 (ORNL-3582(p.18-19)) MEASUREMENT OF THE HYPERFINE SPLITTING IN SEVERAL ALLOYS OF IRON–RHODIUM. F. E. Obenshain, L. D. Roberts, D. W. Forester, J. O. Thomson, and H. H. F. Wegener (Oak Ridge National Lab., Tenn.).

The temperature dependence of the iron hyperfine splitting for several iron-rhodium alloys has been measured using the Mössbauer effect in both the ferromagnetic and antiferromagnetic phase. The Curie temperatures, effective Néel temperatures, and ferromagnetic-to-antiferromagnetic transition temperatures are given for the alloys. (auth)

25983 (SGAE-ME-1/1964) THEORETISCHE UBERLEGUNGEN ZUR XENON- UND BARIUMDIFFUSION AUS UNGECOATETEN BZW. GECOATETEN KERAMISCHEN BRENNSTOFFTEILCHEN. (Theoretical Study on Xenon and Barium Diffusion on Uncoated and Coated Ceramic Fuel Particles). A. Hoeld (Österreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf, Austria). Jan. 1964. 23p.

The diffusion of fission products from coated and uncoated ceramic fuel materials was studied. Formation

of radioactive fission products in an irradiated uranium sample was calculated. The theory of fission-product diffusion is discussed. Experimental determinations of the relative free-settling part for gaseous and solid fission products are described. (M.C.G.)

25984 (TID-20639) THE SODIUM–STRONTIUM EQUILIBRIUM SYSTEM (thesis). William Owen Roberts (Syracuse Univ., N. Y.). May 1964. Contract AT(30-1)-906. 99p.

The sodium-strontium equilibrium system was investigated using thermal analysis, differential thermal analysis, and x-ray diffraction methods over the entire composition range from 100 at.% sodium to 100 at.% strontium. Limited solid solubility was observed to occur at the strontium-rich end of the diagram. The solid solubility of strontium in sodium was very small. One intermediate phase which was thought to be a superlattice was observed to exist in the face-centered-cubic strontium solid solution. In the composition range of 83 to 96.5 at.% strontium and at 635°C a peritectic reaction occurred: liquid + $\delta-$ (bcc) $\rightleftharpoons$ $\gamma-$ (hcp). Another peritectic reaction occurred between 14 and 90 at.% strontium at 192°C: liquid + $\gamma-$ (hcp) $\rightleftharpoons$ $\beta-$ (fcc). The eutectic extended from virtually 0 to 88 at.% strontium. The eutectic temperature was 94°C and the eutectic composition was 1.3 at.% strontium. Pure strontium was prepared by vacuum distillation of the technical grade metal. The purified strontium exhibited a melting point of 774°C. It displayed polymorphic transformations as follows: $\delta-$ (bcc) $\xleftarrow{620°}$ $\gamma-$ (hcp) $\xleftarrow{232°}$ $\beta-$ (fcc). (auth)

25985 (WADD-TR-60-132(Pt.III)) REFRACTORY METAL CONSTITUTION DIAGRAMS. V. Nerses (Nuclear Metals. Div. of Textron Inc., West Concord, Mass.); L. F. Pease (Massachusetts Inst. of Tech., Cambridge); Research Labs., Pittsburgh). Oct. 1963. Contract AF33 (616)-7157. 299p.

Data on six binary constitution diagrams and four ternary constitution diagrams of some of the refractory metals are presented. The binary diagrams include Nb–Ru, Nb–Ir, Nb–Rh, Nf–Hf, Mo–Ir, and W–Pd; the ternaries are Mo–Zr–Ti, Ta–W–Zr, W–Mo–Os, and W–Re–Hf, The quaternary Mo–Zr–Ti–C in the molybdenum rich region at low carbon contents (≤1 wt %) was superficially examined. Care was taken to obtain reliable diagrams. In particular the purity of the elements (99.9% +) was protected when possible, and the temperatures were measured to an accuracy of ±20°C. (auth)

25986 (WADD-TR-60-581(Pt.IV)) THERMAL PROPERTIES OF REFRACTORY MATERIALS. R. E. Taylor and M. M. Nakata (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 1963. Contract AF33(657)-7136. 116p.

A technique for measuring thermal diffusivity at high temperatures is described. The diffusivity is determined from the time interval separating two radial isotherms in a cylindrical specimen. Observations are made during transient heating (or cooling), using a sensitive photoelectric pyrometer developed for this purpose. Measurements are reported on Armco iron, Ta, W, TiC, ZrC, HfC, and TaC. Thermal conductivity results on certain refractory materials, previously reported by other laboratories, were not considered valid. Data were obtained on TiC, TiN, and ZrC, in order to check the previous results and to provide internal standards for testing the thermal diffusivity technique. Data, which disprove the previous literature results, are reported on these compounds. Work on the thermal expansion and specific heat of various refractory materials is also described. (auth)

25987 (NP-tr-1247) THERMAL AND TEMPERATURE CONDUCTIVITY OF POROUS SINTERED MATERIALS. W. Richter. Translated by L. F. Secretan (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.), from Wiss. Z. Hochsch. Maschinenbau Karl-Marx-Stadt, 4: 37-42(1962). 20p.

The temperature conductivity (thermal diffusivity) can be measured by an improved Grüneisen method. For ceramic materials, it decreases rapidly with increase in pore volume. The values determined were rather below those expected from calculations by Eucken's method. The temperature conductivity of sintered iron was found to decrease with increasing pore volume at high temperatures, and increase at low temperatures. Increasing the sintering time always leads to an increase in temperature conductivity, for the fine pores disappear on sintering in the range investigated. The size of the internal surface of the pores is represented as a parameter in the expression for the temperature conductivity of a sintered body, and can be considered a criterion of the progress of sintering. (auth)

25988 NEW INTERMEDIATE PHASES IN SYSTEMS OF Nb OR Ta WITH Rh, Ir, Pd, OR Pt. B. C. Giessen and N. J. Grant (Massachusetts Inst. of Tech., Cambridge). Acta Cryst., 17: 615-16(May 10, 1964).

New intermediate phases in systems of Nb or Ta with Rh, Ir, Pd, or Pt are reported, along with their cell structures. On comparing the mean atomic volumes for each phase to those calculated from a Vegard's law straight line, it was found that there is a strong contraction for AB and AB_3 phases, especially $TaPt_2$ and $TaRh_2$, Nb_3Rh_5 being intermediate. The results support the concept that the determining factor for the stability of a given layer structure is the valence electron/atom ratio, resulting in 2- or 3-layer structures, but that small changes of this quantity and of the size factor, especially by off-stoichiometry or impurities, influence the layer type and produce more complex close-packed intermediate structures. (P.C.H.)

25989 GADOLINIUM AND DYSPROSIUM INTERMETALLIC PHASES. III. THE STRUCTURES OF Gd_3Al_2, Dy_3Al_2, Gd_5Ge_3, Dy_5Ge_3 AND $DyAl_3$. N. C. Baenziger and J. J. Hegenbarth (Univ. of Iowa, Iowa City). Acta Cryst., 17: 620-1(May 10, 1964).

The structures of Dy_3Al_2 and Gd_3Al_2 were determined by single-crystal x-ray-diffraction techniques, and the structures of Gd_5Ge_3 and Dy_5Ge_3 were determined by a combination of single-crystal and powder-diffraction methods. Powder diagrams of $DyAl_3$ were indexed with a hexagonal unit cell. Data, including atomic and interatomic distances, are tabulated. (P.C.H.)

25990 ATOMIC VIBRATIONS AND THE MELTING PROCESS IN METALS. D. McLachlan, Jr. (Univ. of Denver) and L. L. Chamberlain. Acta Met., 12: 571-6 (May 1964).

It is shown that the Grüneisen equation for potential energy (as a function of distances between the atoms) provides for instability in the lattice of crystalline metals when the amplitude of vibration exceeds a critical distance, $(r_i - r_0)$. Upon this basis the general theory was tested by comparing the experimental melting temperatures of 31 elements of the periodic table with those computed from the theory. A different equation is required for the close-packed structures than for the loose-packed structures. (auth)

25991 A TRANSITION IN THE MICROSTRAIN CHARACTERISTICS OF BERYLLIUM. W. Bonfield and C. H. Li (Honeywell Research Center, Hopkins, Minn.). Acta Met., 12: 577-83(May 1964).

A transition was found in the strain hardening rate during the microstrain region of Be from both load-unload and continuous measurement techniques. Using transmission electron microscopy, a study was made of the relation between the transition in microstrain characteristics and the dislocation structure of the material. The initial deformation (Stage A') was observed to be heterogeneous, with considerable increases in the length of dislocation line per unit volume occurring in a few grains. With further strain (Stage B') there was a large increase in the number of grains exhibiting dislocation movement and also a change in the nature of the deformation, with jogged dislocations and elongated loops being observed. From the results some general correlations were made as to the nature of the transition in microstrain characteristics, together with a qualitative assessment of the role of dislocation sources, multiplication, and strain hardening in the microstrain region of Be. (auth)

25992 PHASE TRANSFORMATIONS IN NIOBIUM INVOLVING INTERSTITIALS. L. I. Van Torne and G. Thomas (Univ. of California, Berkeley). Acta Met., 12: 601-15(May 1964).

A homogeneous phase transformation bcc Nb to a fcc lattice, probably NbO but containing C + N also, was observed by transmission electron microscopy both in thin foils and in bulk specimens containing ~0.5 at. % interstitials after suitable aging treatments. The transformation proceeds in the following sequence: ordering in Nb with interstitials taking $\frac{1}{2}\frac{1}{2}0$, $00\frac{1}{2}$ sites; formation of a precipitate in alternate prisms of Nb and NbO; growth to perfect NbO structure; recrystallization of NbO above 1000°C. In thin foils the crystallographic features of the transformation are [001]Nb || [001]NbO, (011)Nb || (111)NbO. The habit planes are four variants of {101} but only those inclined at less than 90° to the foil surface operate. In bulk specimens the habit planes are observed to be {021}, which is in accord with the crystallographic theory for martensitic transformations. The difference between bulk and thin film behavior is attributed to the lack of constraints in the latter where the strains appear to be accommodated elastically. Conversely, in bulk specimens, dislocations are generated from the precipitate-matrix interfaces. (auth)

25993 THE RECOVERY OF THE ELECTRICAL RESISTIVITY OF COLD-WORKED TUNGSTEN. H. Schultz (OSRAM— Studiengesellschaft, Augsburg, Ger.). Acta Met., 12: 649-64(May 1964). (In German)

The recovery of the electric resistivity after cold-work was investigated in zone-refined W, in powder metallurgically prepared W, and in impurity-doped W. In the zone-refined material, deformation at 80°C results in a continuous recovery range from 100 to 300°C, followed by stage III from 300 to 500°C, a continuous recovery range (IV) from 500 to 800°C, and finally stage V from 800 to 1000°C. Recrystallization starts at 920°C. Activation energies obtained were 1.47 ± 0.05 ev for the range 200 to 250°C, 1.70 to 1.95 ev for stage III, and 3.3 ± 0.1 ev for the range 600 to 920°C. In stage III the isothermal recovery follows a $\sqrt{t}$-law in the beginning, and second order kinetics in the middle and at the end of the interval. Impurities (0.1 at. %) have a rather small influence on stage III, but affect stages IV and V considerably. The following interpretations are discussed for stage III: A change in the configuration of interstitial-type impurities and the annihilation of point defects. Since the mechanisms of diffusion walk of interstitial impurity atoms in W are still uncertain, no definite assignment can be made for the contribution of such processes. The similarity in the kinetics of the recovery processes in other bcc and fcc metals suggests, however, that interstitials annihilate at vacancies. For the processes above 500°C it is uncertain to which degree point defects and dislocations contribute to the observed resistivity changes. (auth)

25994 SELF-DIFFUSION AND THE MELTING PARAMETERS OF CUBIC METALS. G. B. Gibbs (General Electricity Generating Board, Berkeley Glos., Eng.). Acta Met., 12: 673-4(May 1964).

The possibility that departures from the equation for the activation energy, ΔHcal/mole ($\Delta H \approx 38T_m$, where T_m is the melting temperature in °K) if the empirical equation is a special case of a more general rule is considered. (P.C.H.)

25995 MATERIAL PROBLEMS FOR THE USE OF PLUTONIUM AS REACTOR FUEL. Ulrich Benedict (Transuran-Istitut, Karlsruhe, Ger.). At. Strom., 10: 17-22(Mar. 1964). (In German)

The various plutonium-containing fuel elements used in reactors or proposed for use are discussed. Some of the most important properties for reactor applications of plutonium compounds, plutonium alloys, and other plutonium-containing materials were compiled and compared. The most important material problems in shaping and working the individual fuel elements are described. Existing or planned reactor types, which use plutonium fuel elements, were tabulated. (tr-auth)

25996 MATERIAL SELECTION FOR NUCLEAR FUEL REPROCESSING PLANT DISSOLVER. H. Dreissigacker (Eurochemic, Mol, Belg.). Chem. Process Eng., 45: 253-7 (May 1964).

The new Eurochemic plant under construction at Mol for the reprocessing of irradiated nuclear fuels will have a universal dissolver for the chemical decladding and the dissolution of nuclear fuel element cores, so that elements having various combinations of cladding and core materials can be dissolved in the same equipment. The material of construction selected for the dissolver is of the type 22 Cr-42 Ni-3 Mo-2.5 Cu-1 Ti-balance Fe. This material is susceptible to weld decay in boiling 11 to 13M HNO_3 and Zirflex solutions. The standard material was modified to improve corrosion resistance and fabrication properties. Corrosion tests were carried out both for the standard material and a material approximating to the Eurochemic specification. The results indicate that the modified material is not susceptible to weld-decay. (P.C.H.)

25997 FORCE CONSTANTS OF THE GRAPHITE LATTICE FROM SPECIFIC HEAT DATA. Tun-chien Lee and Jenn-lin Hwang (National Taiwan Univ., Taipei). Chinese J. Phys. (Taiwan), 1: 85-7(Oct. 1963).

The force constants between nearest neighbors in planes and between nearest neighbors in adjacent planes were determined using the theory of Krumshansl and Brooks and the specific heat data of van der Hoven and Keesom. The theory is shown to be consistent with the experimental data. Further, a theory that explains the low-temperature behavior of the specific heat as a composite effect of stretching as well as bending modes is shown to be inconsistent with experiment. (D.C.W.)

25998 THE CHROMIUM–MOLYBDENUM PHASE DIAGRAM. V. N. Sbechnikov and G. F. Kobzenko (Inst. of Metal Physics, Ukrainian Academy of Sciences, SSR). Dokl. Akad. Nauk SSSR, 155: 611-4(Mar. 21, 1964). (In Russian)

Cr–Mo alloys were studied by thermal, x-ray, and dilatometric methods. The alloys were fused 5 to 7 times in purified argon. The alloys were annealed at temperatures of 1600 (97 hrs), 1550 (110 hrs), 1350 (55 hrs), 1275 (85 hrs), 1225 (100 hrs), 1115 (200 hrs), 1000 (417 hrs), and 800°C (900 hrs). X-ray analysis showed the presence of only a single, body-centered cubic lattice structure. The lattice parameters increased monotonically with increasing Mo content in the alloy. The value of a(Cr) was 0.2882 and that of a(Mo) was 0.3139 nm. The average linear expansion coefficients $\bar{\alpha}$ of the Cr–Mo alloys were intermediate between the values of $\bar{\alpha}$(Cr) and that of $\bar{\alpha}$(Mo). The Cr–Mo alloy with 82 to 84% Mo had the same thermal expansion as Al_2O_3. No volume changes could be observed that could be related to phase transformations. The phase diagram of the Cr–Mo system belongs to type III of the Rozebom classification. The minimum on the solidus and liquidus curves occurred at a temperature of 1820°C and a concentration of 20 to 22% Mo. The data showed that Cr–Mo form a continuous series of solid solution above 800°C. (TTT)

25999 SOME REGULARITIES IN THE CHANGING PROPERTIES OF NIOBIUM-BASED ALLOYS. R. A. Ul'yanov and N. D. Tarasov. Fiz. Met. i Metalloved., 17: 223-8(1964).

Niobium-base alloys with additions of Ta, W, Mo, Cr, Re, Pd, Ir, Ti, Zr, B, Si, and La, prepared by arc fusion in Ar, were examined for the lattice parameter (0 to 14% additions), hardness (0 to 10% additions), and electric resistance (0.8% additions) at 20 and 200 to 1800°C. The results show that the lattice parameter is greater for metals with greater atomic diameter, and the greater the difference between the atomic diameters of Nb and the alloying metal, the greater the change in the lattice parameter of the alloy. The hardness and the specific electric resistance follow a similar pattern. Cr, Zr, Pd, Re, and Ti produced greater increases in resistance than other additions. (A.I.D. Press, Vol. 2: No. 234, May 1964)

26000 PHASE COMPONENTS OF THE TANTALUM–CARBON SYSTEMS. L. B. Dubrovskaya, G. P. Shveikin, and P. V. Gel'd (Inst. of Chemistry, Academy of Sciences, Ukrainian SSR and Ural Polytechnic Inst., USSR). Fiz. Metal. i Metalloved., 17: 73-7(Jan. 1964). (In Russian)

Phase studies were made of Ta–C systems, and the results were correlated with published data. It was shown that in addition to β and γ phases there are indications of a ζ phase. (R.V.J.)

26001 DIFFUSION REACTION IN Mo–Si SYSTEM. V. E. Ivanov, E. P. Nichiporenko, and V. I. Zmii (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Fiz. Metal. i Metalloved., 17: 94-9(Jan. 1964). (In Russian)

In Mo–Si diffusion processes silicon plays a prevailing role. The growth of Mo_5Si_3 and $MoSi_2$ layers follows a parabolic law. Coefficients of silicon diffusion into Mo_5Si_3 and $MoSi_2$ at 1250°C were estimated on the basis of the parabolic growth. (R.V.J.)

26002 MECHANISM OF STATIONARY CREEP OF BODY CENTERED METALS AT HIGH TEMPERATURES. CREEP OF ZIRCONIUM. L. I. Ivanov and V. A. Yankuchevich (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Fiz. Metal. i Metalloved., 17: 112-17(Jan. 1964). (In Russian)

Data are given on high temperature (1050 to 1380°C) creep in twisted Zr. A dislocation model of body centered crystals of pure metals with low moduli of elasticity was presented. (R.V.J.)

26003 REVERSIBILITY OF $\beta-\omega$ TRANSFORMATION IN Zr-16% Nb ALLOYS. Yu. F. Bychkov, V. A. Ivanov, and A. I. Rozanov (Moscow Inst. of Physical Engineering). Fiz. Metal. i Metalloved., 17: 547-53(Apr. 1964). (In Russian)

The ω-phase formed during initial annealing of Zr–16% Nb β-solid solution at 240 to 300°C was transformed back into β-solid solution by a second short-duration tempering at 550 to 575°C, showing that under certain conditions $\omega \rightarrow \beta$ transition is possible. (R.V.J.)

26004 ON THE STRENGTH AND DECOMPOSITION MECHANISM OF METAL CERAMIC SOLID SOLUTIONS OF WC–Co UNDER COMPRESSION. G. S. Kreimer, V. I. Tumanov, D. S. Kamenskaya, and Z. I. Pavlova (All-Union Inst. of Hard Metals, USSR). Fiz. Metal. i Metalloved., 17: 572-7(Apr. 1964). (In Russian)

Compressive strength of WC–Co with various Co and carbide contents was investigated. Equations for Orowan and Ansell-Lenel dislocation models for dispersion strengthened two-phase alloys describe well the WC–Co strength as a function of Co content. It is shown that the assumed presence of 10^{-6} cm cobalt interlayers results in a correct definition of the maximum yield and compression strengths. (tr-auth)

26005 ON THE TEMPERING OF Be–Ni ALLOYS. I. I. Papirov, G. F. Tikhinskii, and V. A. Finkel (Inst. of Physics and Tech., Academy of Sciences, USSR). Fiz. Metal. i Metalloved., 17: 613-14(Apr. 1964). (In Russian)

High-speed tempering (100 to 400°C) of Be–Ni alloys was studied in order to find β-phase Be at room temperature. α–Be lines appeared at 340°C. A nondiffusion $\beta-\alpha$ transformation was observed with low-temperature tempering. Tempering of pre-eutectoid alloys with 5 to 20 wt % Ni introduced $\alpha-\beta$ lines. These results indicate that it is possible to anneal β–Be to room temperature by high-speed tempering of Be–Ni alloys. (R.V.J.)

26006 YOUNG'S MODULUS ANOMALIES IN RARE EARTH FERROMAGNETS. K. P. Belov, R. Z. Levitin, L. A. Nalevskaya, and V. I. Sokolov. Fiz. Metal. i Metalloved., 17: 617-19(Apr. 1964). (In Russian)

Young's modulus for Dy, Ho, Er, and Gd was studied for a wide range of temperatures including the Θ_2 and the transition temperature from ferromagnetic to antiferromagnetic Θ_1 state. (R.V.J.)

26007 TEMPERATURE DEPENDENCE OF ELECTRIC CONDUCTIVITY OF MOLYBDENUM MONOCRYSTALS. N. V. Volkenshtein, E. P. Romanov, L. S. Starostina, and V. E. Startsev (Inst. of Crystallography, Academy of Sciences, USSR and Inst. of Metals of Physics, Academy of Sciences, USSR). Fiz. Metal. i Metalloved., 17: 627-9 (Apr. 1964). (In Russian)

Electric resistance of pure Mo monocrystals with $R_{300°K}/R_{4.2°K} \cong 4600$ was studied in order to determine the mechanism of conductance electron scattering. The linear resistance as a function of temperature, determined by conductance electrons, is retained at 100°K. Electric resistance at 20°K or below is determined by electron-electron interaction. The temperature-resistance curve

for polycrystalline specimens showed a minimum resistance at 26°K, while highly purified Mo monocrystal had no minimum. (R.V.J.)

26008 PREPARATION AND PROPERTIES OF PLUTONIUM-BEARING OXIDE PARTICULATES. Lerroy V. Jones, Donald Ofte, Kenneth D. Phipps, and Philip A. Tucker (Monsanto Research Corp., Miamisburg, Ohio). Ind. Eng. Chem., Prod. Res. Depart., 3: 78-82(June 1964).

Microspheres of plutonium dioxide and plutonium dioxide combined with uranium dioxide, thorium dioxide, and zirconium dioxide were prepared in an induction-coupled plasma torch. The microspheres are thermally and chemically stable, and exhibit a remarkable freedom from loose contamination. Feed material for the process was prepared by die pressing the oxide powders, sintering the pellets, and grinding the fired pellets to the desired size. An oxygen-enriched plasma was employed to inhibit the loss of oxygen from plutonium dioxide during melting. The spheroidal particles were characterized by x-ray-diffraction analysis, by measurement of their physical properties, and by evaluation of their chemical inertness. Plutonium-bearing microspheres are applicable to dispersion, slurry, and paste-type reactor fuels. (auth)

26009 STUDY OF BERYLLIUM AND CHROMIUM WHISKERS. V. M. Amonenko, B. M. Vasyutinskii, G. N. Kartmazov, I. I. Papiov, G. F. Tikhinskii, and B. A. Finkel. Issled. po Vysokoprochnym Splavam i Nitevidnym Kristallam, Akad. Nauk SSSR, Inst. Met., Dokl. na Nauchn. Sessii 1962, 34-6(1963).

Beryllium and Cr whiskers were obtained by vacuum vapor deposition of 99.9% pure Be and 99.9% pure Cr on a Mo substrate. The Be whiskers were grown at evaporation temperatures of 1365 to 1600°C and condensation temperature of 770 to 950°C. The condensation rate amounted to 0.01 to 0.07 g/cm^2/hr. The Cr whiskers were grown at evaporation temperatures of 1320 to 1460°C, condensation temperatures of 1050 to 1200°C, and a condensation rate of 0.03 to 0.07 g/cm^2/hr. The whiskers were 10 mm long with a polygonal cross section of 0.0001 to 0.01 mm^2 for Be and of 0.000005 to 0.01 mm^2 for Cr. X-ray-diffraction patterns showed that all whiskers were single crystals. The direction of growth of Be whiskers coincides with the [221], [331], and [111] axes. Chromium whiskers were subjected to a tensile test. As usual, the tensile strength decreased as the cross section increased. The highest strength, 270 kg/mm^2, was obtained in Cr whiskers with a cross section of 0.00002 mm^2. (OTS)

26010 KINETICS OF DIFFUSION OF ALLOYING METALS IN LIQUID IRON. P. M. Shurygin and V. D. Shantarin. Izv. Akad. Nauk SSSR, Met. i Gorn. Delo, No. 2, 38-40(Mar.-Apr. 1964). (In Russian)

The rate of diffusion of pure Cr, Ti, Mo, and W and technological FeMo (62% Mo), FeW (74% W), and FeNb (60% Nb) at 1923°K showed that the pure metals follow the Ti–Cr–W–Mo sequence of diffusion with ferrotungsten exhibiting the most rapid rate of diffusion among the ferromagnets examined. (R.V.J.)

26011 INVESTIGATIONS ON β-MODIFICATION TORSION CREEP IN Ti–Zr ALLOY. K. A. Asipov and A. L. Sotnichenko. Izv. Akad. Nauk SSSR, Met. i Gorn. Delo, No. 2, 161-3(Mar.-Apr. 1964). (In Russian)

The activation energy of steady creep in the β modification of Ti–Zr alloy reaches a maximum of 35 kcal/mole of zirconium. The concentration dependence of activation energy for steady creep under torsion or under ductility forces was found to be identical while quantitative activation energy differences are described by the difference in the intensity state of these two types of tests. (R.V.J.)

26012 PROPERTIES OF SOLID SOLUTION Nb–Mo–Cr ALLOYS AT HIGH TEMPERATURES. N. N. Kurnakov and M. M. Savel'eva. Izv. Akad. Nauk SSSR, Met. i Gorn. Delo, No. 2, 164-6(Mar.-Apr. 1964). (In Russian)

The high-temperature hardness, oxidation, and heat resistance of Nb–Mo–Cr alloys (2.5 to 5 at.% Cr and 20 at.% Mo) were tested at temperatures from 20 to 1100°C. Molybdenum and chromium improve the hardness of the alloy at temperatures to 1100°C. The lower rate of oxidation was observed in alloys with 5 at.% Mo and 2.5 to 5% at.% Cr. (R.V.J.)

26013 DIFFUSION REACTION IN THE Mo–Be SYSTEM. N. N. Matyushenko. Izv. Akad. Nauk SSSR, Met. i Gorn. Delo, No. 2, 167-71(Mar.-Apr. 1964). (In Russian)

The diffusion mechanism of the intermetallic compounds was studied using the diffusion annealing reaction of Mo in Be vapors at 900 to 1250°C. Beryllide phases appear on the Mo as layers of lower to higher beryllides. The $MoBe_{22}$ phase was found to be the main diffusion layer in continuous molybdenum beryllization. (R.V.J.)

26014 VAPOR PRESSURE OVER SOLID BERYLLIUM. G. P. Kovtun, A. A. Kruglykh, and V. S. Pavlov. Izv. Akad. Nauk SSSR, Met. i Gorn. Delo, No. 2, 177-9(Mar.-Apr. 1964). (In Russian)

The vapor pressure in 99.95% Be with Fe, Si, Al, Cr, and Ni impurities not exceeding 0.001% (for each component) studied at 905 to 1100°C showed a heat of sublimation of 88.62 kcal/g atom. (R.V.J.)

26015 NONEQUILIBRIUM EVAPORATION OF TANTALUM. V. A. Shustrov, R. M. Khasanov, and A. Kh. Ayukhanov (Inst. of Physics and Tech., Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 1, 31-4(1964). (In Russian)

Studies of tantalum evaporation using a Ta^{182}-containing target showed nonequilibrium evaporation at 2800°K. The nonequilibrium evaporation is related to impure molecules. The heat of sublimation of such impure tantalum is at 1450 to 1850°K. (R.V.J.)

26016 DETERMINATION OF LATTICE VACANCIES IN GRAPHITE. G. R. Hennig (Argonne National Lab., Ill.). J. Chem. Phys., 40: 2877-82(May 15, 1964).

Vacancies in graphite crystals can be rendered visible for electron microscopy by a technique which combines cleaving, etching, and decorating. The crystals are cleaved, and the vacant lattice sites in the exposed surface are attacked by a mixture of chlorine and oxygen, which expands these vacancies into monolayer loops of any desired diameter. These loops are decorated with gold to enhance their contrast. Numerous tests have established that the loop concentration is a quantitative measure of the vacancy concentration. The method is capable of determining vacancies at concentrations at least as low as 10^{-10} per carbon atom. The relative chemical reactivities of carbon atoms surrounding a vacancy of carbon atoms at the edges of layers and of carbon atoms within layers were measured. (auth)

26017 A STUDY OF THE CALCIUM MOLYBDATE-RARE EARTH NIOBATE SYSTEMS. L. H. Brixner (E. I. du Pont de Nemours & Co., Wilmington, Del.). J. Electrochem. Soc., 111: 690-7(June 1964).

Single crystals of rare earth niobate-calcium molybdates were grown by the Czocharalski technique, and the distribution coefficients were determined. Simulated emission was obtained from a 3 in. long $NdNbO_4$ doped $CaMoO_4$ crystal. (P.C.H.)

26018 DIRECT CURRENT MEASUREMENT OF FUSED SALT CONDUCTIVITY: MOLTEN NITRATES. Lowell A. King and F. R. Duke (Ames Lab., Ames, Iowa). J. Electrochem. Soc., 111: 712-16(June 1964). (IS-659)

The practicability of a direct current technique for determination of fused salt specific conductivity was demonstrated. Simple conductivity cell design and electrical circuits minimized many of the problems associated with alternate current techniques. Experimentally determined cell constants were very nearly those calculable from cell geometry. The direct current conductivities of $LiNO_3$, $NaNO_3$, KNO_3, and their binary mixtures were determined. The results were in agreement with published alternating current values, where available. (auth)

26019 DIRECT CURRENT MEASUREMENT OF FUSED SALT CONDUCTIVITY. II. KCl–LiCl. F. R. Duke and Lynn Bissell (Ames Lab., Ames, Iowa). J. Electrochem. Soc., 111: 717-19(June 1964). (IS-725)

Direct-current measurements were used to determine the electrical conductivity of the fused potassium chloride–lithium chloride system. Specific conductivity was determined for the pure salts and five of their mixtures as a function of temperature. In all cases, the specific conductivity increased with temperature. Agreement with others on the specific conductivity of KCl was excellent. The addition of water to dry lithium chloride was found to lower the specific conductivity at a given temperature. The equivalent conductivity and apparent activation energy of ionic migration were computed using the density data of others. (auth)

26020 ELECTRIC CONDUCTIVITY OF FUSED $LiNO_3$–$NaNO_3$–KNO_3 EUTECTIC. Lowell A. King, C. Lynn Bissell, and F. R. Duke (Ames Lab., Ames, Iowa). J. Electrochem. Soc., 111: 720-1(June 1964). (IS-708)

Simple, sensitive reference electrodes are described for use in direct current measurement of fused salt conductivity. They consist of silver wires dipping into a very dilute solution of Ag^+ in the salt under investigation. The ternary eutectic of $LiNO_3$, $NaNO_3$, and KNO_3 was chosen to demonstrate the technique. Specific conductivity of the system was measured from 134 to 384°C. (auth)

26021 THE EFFECT OF SUBSTRUCTURE ON THE NUCLEATION OF GRAIN-BOUNDARY CAVITIES IN MAGNESIUM. A. E. B. Presland and R. I. Hutchinson (International Research and Development Co., Ltd., Newcastle-upon-Tyne, Eng.). J. Inst. Metals, 92: 264-9(May 1964).

Transmission electron microscopy of magnesium permitted the observation of grain-boundary cavities in thin foils prepared from suitably strained test-pieces. The intersection of a grain boundary as a sub-grain boundary was identified as the principal cavitation site and a nucleation mechanism is proposed that accounts qualitatively for the available data on cavitation as a function of strain, strain rate, and temperature. (auth)

26022 CELLULAR PRECIPITATION IN NIOBIUM–CHROMIUM ALLOYS. J. S. Hirschhorn and R. A. Gregg (Pratt and Whitney Aircraft, North Haven, Conn.). J. Less-Common Metals, 6: 333-44(May 1964).

Cellular precipitation of $NbCr_2$ in Nb–Cr alloys was studied by optical and electron metallography and by microhardness measurements. Observation of precipitation along the cell-matrix interface supports a new extension to the original theory of cellular precipitation; that is, when the process occurs at high temperatures (≥0.6 of the absolute liquidus temperature) cell growth is controlled by lattice diffusion instead of by short-circuit boundary diffusion. Cell growth is not found to be inhibited by small amounts of general precipitation or large amounts of Widmanstätten precipitation of $NbCr_2$ within grains but sub-boundaries on which precipitation has occurred can stop all growth. Cell hardness is higher in water-quenched than in argon-quenched specimens. (auth)

26023 A CONSTITUTION DIAGRAM FOR THE TUNGSTEN–PALLADIUM SYSTEM. W. K. Goetz and J. H. Brophy (Massachusetts Inst. of Tech., Cambridge). J. Less-Common Metals, 6: 345-53(May 1964).

The tungsten–palladium phase diagram was determined by x-ray and metallographic investigation at temperatures above 1100°C. Tungsten dissoves a maximum of 5% palladium at the peritectic temperature, 1815°C. The solubility of palladium in tungsten at 1100°C is 1.5%. The palladium solid solution forms by the peritectic reaction of the tungsten and liquid phases at 1815°C. At the peritectic temperature, palladium dissolves 22% tungsten. At 1100°C the solubility of tungsten in palladium is reduced to 21.5%. No intermediate phases are present at temperatures above 1100°C. (auth)

26024 THE STRUCTURES OF NIOBIUM–HYDRIDE ALLOYS. C. Wainwright, A. J. Cook, and B. E. Hopkins (National Physical Lab., Teddington, Middx., Eng.). J. Less-Common Metals, 6: 363-74(May 1964).

A series of niobium–hydrogen alloys with compositions in the two-phase and single-phase hydride fields was examined at room temperature by x-ray diffractometer techniques. The closeness of the hydride structure to the cubic body-centered form allows simple formulas to be used to represent each complex diffraction profile in terms of a group of elementary components. The results are explained if the unit cells are slightly tetragonal and if there is a small departure from 90° of the angle opposite the c axis; thus the characteristics are comparable with those of the related tantalum hydride, though the c/a ratios are much closer to unity. The symmetry of this arrangement is orthorhombic, the corresponding face-centered cell having sides a_0, b_0, c_0 (= c) where a_0 and b_0 approximate to $\sqrt{2}c_0$, and a volume twice that of the body-centered cell. The edge parameters and the angular distortion vary across the single-phase field, and the latter also varies to a smaller extent across the two-phase field. It is suggested that this abnormal behavior may be the result of lack of equilibrium or of an exceptional sensitivity of the niobium-hydrogen system to the presence of small amounts of impurity. (auth)

26025 A COMPARISON OF MAGNOX A 12 AND ZA ALLOYS AS CANNING MATERIALS FOR NUCLEAR REACTORS. P. Greenfield (English Electric Co. Ltd., Whetstone, Leicester, Eng.). J. Nucl. Mater., 11: 121-34(Feb.-Mar. 1964).

The properties of the Mg alloys ZA and A 12 were compared for their use as fuel element canning materials in power reactors of the Calder Hall type. It was concluded that ZA shows more resistance to grain growth than A 12

and also possesses superior mechanical properties in that ZA has a higher rupture ductility, is free from grain boundary cavitation effects, has a higher fatigue strength, and a resistance to creep at high temperatures as good as that of A 12. The resistance to oxidation in CO_2 is similar in both alloys but in gross fault conditions in which large amounts of air are included in the coolant at high temperatures, then A 12 is more resistant to severe attack. The ignition temperatures of A 12 are slightly higher than those of ZA. Despite the more attractive mechanical characteristics of ZA, fuel elements clad in A 12 have performed satisfactorily whereas ZA canned elements in the Calder Hall and Chapelcross reactors have had to be discharged at low burn-ups. This has been shown to be due to the diffusion of Pu through the ZA can walls, while A 12 presents an excellent barrier to such diffusion at current fuel element temperatures. (auth)

26026 THE MECHANICAL PROPERTIES OF QUENCHED URANIUM–MOLYBDENUM ALLOYS. PART I. TENSILE TESTS ON POLYCRYSTALLINE SPECIMENS. R. F. Hills, B. R. Butcher, and B. W. Howlett (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nucl. Mater., 11: 149-62(Feb.-Mar. 1964). (AERE-R-4208)

Tensile tests were performed on specimens of U alloys containing from 1.5 to 30 at.% Mo in the oil-quenched and Hg-quenched condition. The form of the results in general agrees with that suggested by previously obtained hardness values. Two forms of cracking were found at certain ranges of composition; the first type was due to stress-corrosion by air, the second was a form of intergranular brittleness. The results are listed and discussed. (auth)

26027 THE MECHANICAL PROPERTIES OF QUENCHED URANIUM–MOLYBDENUM ALLOYS. PART II. A PRELIMINARY SURVEY OF THE DEFORMATION MECHANISMS. B. R. Butcher (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and B. A. Hatt. J. Nucl. Mater., 11: 163-82(Feb.-Mar. 1964). (AERE-R-4353)

The deformation of compressed specimens of the martensitic α structures and the metastable γ phases of quenched U–Mo alloys containing 3 to 30 at.% Mo was investigated by metallographic and x-ray means. The deformation characteristics of the α phases helped in the qualitative understanding of the strengths shown by these phases. The true γ phase was found to deform by {112} twinning, but one metastable γ phase deforms by {122} twinning, the twins themselves being twinned on {122} planes, while another metastable γ phase also deforms by {122} twinning, but in this case the twins are themselves twinned on {112} planes. The various twinning phenomena are discussed in terms of the order thought to exist in the metastable phases. (auth)

26028 DIMENSIONAL CHANGES OF ZIRCALOY-2 AND ZIRCONIUM–10 wt % NIOBIUM ALLOY DURING ANNEALING IN TEMPERATURE GRADIENT. H. G. Feller (Technische Universität, Berlin). J. Nucl. Mater., 11: 193-202(Feb.-Mar. 1964). (In German)

An investigation was made on the influence of a temperature gradient on dimensional changes of Zircaloy-2 and of a Zr/10 wt.% Nb alloy during annealing above the transformation point. When dimensional changes associated with a homogeneous temperature distribution were compared with those characteristic of a temperature gradient, it turned out that both alloys underwent positive changes in length in the direction of the temperature gradient. (auth)

26029 DEFORMATION MECHANISMS OF β URANIUM SINGLE CRYSTALS. C. Rodriguez and J. A. Coll (Argentine Atomic Energy Commission, Buenos Aires). J. Nucl. Mater., 11: 212-19(Feb.-Mar. 1964).

Single crystals of β-uranium were deformed by bending the tension. Metallographic observation of the deformation produced allows three systems of slip traces to be recognized. Two of them were identified as corresponding to the {110} ⟨001⟩ system and the third to {100} ⟨001⟩. Since the Kronberg zonal dislocation proposed for the {110} ⟨001⟩ system cannot be extended to the (100) slip plane, a new model is submitted in order to explain the {100} ⟨001⟩ mechanism. This model consists of an extended dislocation formed by two Frank partials. The extended dislocation model not only accounts for the differences in morphology observed between the traces corresponding to the two systems, but can also explain the stacking faults reported in the Fe–Cr sigma phase. (auth)

26030 ON THE ACTIVATION ENERGY OF SINTERING NON-STOICHIOMETRIC URANIUM OXIDE. I. Amato, R. L. Colombo, and A. M. Protti (FIAT, Turin). J. Nucl. Mater., 11: 229-35(Feb.-Mar. 1964).

Dilatometric experiments were carried out on the initial stages of sintering UO_2–U_3O_8 mixtures of several compositions, which densified according to the diffusion-controlled mechanism. The diffusion activation energy was of 65,800 ± 6200 cal/mole irrespective of the O/U ratio, and this was considered to be the diffusion activation energy of the U ion in the non-stoichiometric UO_2 lattice. (auth)

26031 TENSILE PROPERTIES OF β-URANIUM. E. C. Sykes (Central Electricity Generating Board, Berkeley, Gloucestershire, Eng.). J. Nucl. Mater., 11: 240-2(Feb.-Mar. 1964).

Experimental determinations of the tensile properties of β phase U and their variation with strain rate and temperature are reported. Tests were conducted at 700 and 750°C with crosshead motions of 1, 0.067, and 0.004 cm/min, equivalent to initial strain rates of 0.2620, 0.0175, and 0.0010/min, respectively. Changes in the specimens were demonstrated if the data are plotted as true stress/strain curves assuming uniform decrease in cross sectional area. These have a peak followed by a rather rapid fall off in strength and suggest that concurrent recrystallization plays a role in effectively weakening the material. The continuing decrease in strength indicates that necking is taking place. (P.C.H.)

26032 GRAIN-BOUNDARY CRACKING IN A MAGNESIUM–ZIRCONIUM ALLOY. J. H. Day (Associated Electrical Industries Ltd., Rugby, Eng.). J. Nucl. Mater., 11: 249-51(Feb.-Mar. 1964).

Studies were made on grain-boundary cracking and mode of creep failure in Mg–Zr alloys. Tensile specimens of impact-extruded strip were strained to failure at 500°C at a rate of 0.01%/hr in a CO_2 atmosphere containing approximately 200 ppm of water vapor. Under these test conditions, hydrogen was absorbed and extensive precipitation of Zr hydride occurred. In common with previous observations, there was a strong tendency for denuded zones to be oriented normal to the stress axis. Selected area diffraction patterns from precipitates extracted on replicas showed that the precipitating phase was ϵ Zr hydride. The mechanisms whereby the hydride phase may aid cavitation are given. (P.C.H.)

26033 REACTOR MATERIALS. E. Klotzbuecher (Maschinenfabrik Augsberg-Nuremburg AG, Nuremburg). Kerntechnik, 6: 168(Apr. 1964). (In German)

Properties necessary for materials for use in a nuclear reactor are discussed. Corrosion resistance, radiation resistance, and the ability to withstand high pressures and temperatures are considered for some reactor materials as examples. (M.C.G.)

26034 REACTOR MATERIALS. O. Machnig (Brown Boveri/KRUPP Reaktorbau GmbH, Mannheim, Ger.). Kerntechnik, 6: 169-70(Apr. 1964). (In German)

Special requirements for reactor materials are considered. Examples discussed include: the cobalt content admissible in reactor steels, requirements for nuclear purity of the reactor core, and the size of radioinduced stresses in graphite structures. (M.C.G.)

26035 DIFFUSION OF OXYGEN IN TUNGSTEN AND SOME OTHER TRANSITION METALS. A. J. Jacobs. Nature, 200: 1310-11(Dec. 28, 1963).

An experimentally determined value of the heat of activation for the diffusion of oxygen in tungsten differs from a recently calculated value. Heat of activation and theoretical and experimental entropy changes are given for the diffusion of oxygen in various transition metals. (Rev. Metal Lit., 21: No. 4, April 1964)

26036 ON INTERMETALLIC COMPOUNDS IN THE SYSTEM HOLMIUM–ALUMINUM. Andreas Meyer (Siemens and Halske AG, Munich). Naturwissenschaften, 51: 189-90(1964). (In German)

Aluminum–holmium alloys were investigated for $HoAl_3$, $HoAl_2$, and HoAl phases and various holmium contents. (M.C.G.)

26037 CORRELATION BETWEEN THE ENERGY OF MOTION OF MONOVACANCIES AND THE MELTING TEMPERATURE OF METALS. K. Mukherjee (Univ. of Illinois, Urbana). Phys. Chem. Solids, 25: 517(May 1964).

It is shown that the energy of motion of a monovacancy can be correlated with the absolute melting temperature of the pure fcc metals. An empirical formula is established and values for Cu, Au, Ag, Al, and Pt are given and compared with experiment. (R.E.U.)

26038 ANISOTROPIC hfs INTERACTIONS IN FERROMAGNETS FROM MÖSSBAUER EFFECT STUDIES. G. K. Wertheim, V. Jaccarino, and J. H. Wernick (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 135: A151-4(July 6, 1964).

The anisotropy of the magnetic hyperfine interaction in ferromagnetic $ZrFe_2$ was demonstrated with the Mössbauer effect. It is suggested that such anisotropy is responsible for the failure to observe domain-wall enhanced NMR in similar materials. It may also account for the failure to detect the NMR of iron atoms with impurity neighbors in dilute ferromagnetic alloys. These atoms are easily seen in Mössbauer effect studies. (auth)

26039 MAGNETIC STRUCTURE OF EUROPIUM. N. G. Nereson, C. E. Olsen, and G. P. Arnold (Los Alamos Scientific Lab., N. Mex.). Phys. Rev., 135: A176-80(July 6, 1964). (LADC-5892)

Neutron diffraction experiments on metallic europium were conducted over a temperature range from room temperature to 4°K. The metal undergoes a transition to an antiferromagnetic state at a Néel temperature T_N of 91°K, and this ordering process continues until saturation develops at about 20°K. A model is proposed of helical spin structure with the magnetic moments lying parallel to a cube face and with the rotation axis directed perpendicular to the moments or along the [100] direction. The pitch of the helix was observed to change very slightly with temperature; the period was 3.5a at $T/T_N = 1$ and increased to 3.6a at $T/T_N = 0.05$ where a is the lattice spacing. On the basis of the model and the intensities of the magnetic reflections, the calculated ordered moment at each atom site is $5.9 \pm 0.4\,\mu_B$ per atom. This measured moment is somewhat less than the maximum theoretical value of $7\,\mu_B$ expected from divalent europium characterized by a spin only ground state of $^8S_{\frac{7}{2}}$. Values of magnetic moment times magnetic form factor, μf, as calculated from Eu coherent magnetic reflections are in agreement with similar values of μf derived from the compound EuO. The intensities of the magnetic diffraction peaks deviate from a Brillouin behavior and instead follow a temperature dependence proportional to $(T_N - T)^{\frac{1}{2}}$ over a considerable region below the Néel temperature. The Debye temperature, as derived from the nuclear peak intensities, exhibited a variation from 70 to 120°K over a corresponding sample temperature range of 100 to 293°K. (auth)

26040 INVESTIGATION OF THE DEPENDENCE OF THE GALVANOMAGNETIC EFFECTS IN GRAPHITE ON TEMPERATURE AND PRESSURE. A. I. Likhter and V. V. Kechin (Inst. for High-Pressure Physics, Moscow). Soviet Phys.-Solid State (English Transl.), 5: 2246-52(May 1964). Translated from Fiz. Tverd. Tela, 5: 3066-74(Nov. 1963).

The resistance, Hall coefficient, and magnetoresistance of natural graphite flakes were measured at atmospheric pressure and at pressures up to 9000 atm in the temperature range 290–420°K. The results of the investigation of the temperature dependence of the Hall coefficient, resistance, and magnetoresistance at atmospheric pressure confirmed the theory of galvanomagnetic properties of graphite developed earlier. The carrier scattering law for graphite was unaffected by pressure up to 10,000 atm. Using the theory developed earlier, changes in the band-structure parameters under pressure were calculated for graphite and the shape of the Fermi surface under pressure was examined. (auth)

26041 INTERNAL FRICTION IN DEFORMED MOLYBDENUM AND ITS ALLOYS WITH ZIRCONIUM AND RHENIUM. S. Z. Bokshtein, M. B. Bronfin, S. T. Kishkin, and V. A. Marichev. Soviet Phys.-Solid State (English Transl.), 5: 2253-6(May 1964). Translated from Fiz. Tverd. Tela, 5: 3075-80(Nov. 1963).

The internal friction Q^{-1} of samples of Mo and Mo–Zr, Mo–Re alloys, annealed and deformed at room temperature, was measured in the temperature range 20–700°C. The temperature dependence of Q^{-1} of deformed samples of Mo and Mo–Zr had a peak which disappeared after annealing below the recrystallization temperature. For a fixed degree of plastic deformation, the temperature at which this peak occurred depended on the grain size. The results are discussed in terms of Köster's ideas. (auth)

26042 ELECTRON DIFFRACTION INVESTIGATION OF HEXAGONAL TUNGSTEN NITRIDE δ_H^{IV} WITH CONSTANTS a = 2.89, c = 10.80 A. V. I. Khitrova (Inst. of Crystallography, Academy of Sciences, USSR). Soviet Phys.-Cryst. (English Transl.), 8: 701-8(May-June 1964). (Translated from Kristallografiya, 8: 873-6(Nov.-Dec. 1963)).

A hexagonal tungsten nitride with constants a = 2.98 and c = 10.80 Å was isolated, and its structure, formed by

hexagonal layers of tungsten atoms with alternation: AA', BB', ... where the prime indicates defect layers with a probability of filling of vacancies of ~0.2 was studied. The space group is $C_{3V}^{4} - P3\bar{1}C$. The positions of the atoms were also determined. (auth)

26043 CRYSTAL STRUCTURE OF Ta_5Ga_3. E. I. Gladyshevskii, V. S. Telegus, and V. Ya. Markiv (Moscow State Univ.). Soviet Phys.-Cryst. (English Transl.), 8: 738-40(May-June 1964). (Translated from Kristallografiya, 8: 921-3(Nov.-Dec. 1963)).

An x-ray-diffraction study established that Ta_5Ga_3 has a tetragonal structure of the W_5Si_3 type. The experimental and theoretical data are given, and the occurrence and lattice constants of compounds of the W_5Si_3 type are discussed. (D.C.W.)

26044 URANIUM ADDITION TO LOW CARBON STEELS. (INFLUENCE OF URANIUM ADDITION ON IRON AND STEEL. PT. 1). Masayoshi Hasegawa and Ichiro Onoda. Tetsu To Hagane, 49: 1788-97(Nov. 1963). (In Japanese)

A laboratory study was made to reveal the principal effects of uranium addition to aluminum-killed low carbon steels on nonmetallic inclusions, austenitic grain size, as-normalized hardness, ferrite and austenite matrices, solubility, transformation points, work-hardening, and corrosion resistance. (Rev. Metal Lit., 21: No. 4, April 1964)

26045 THE CONSTITUTION DIAGRAM TUNGSTEN–RUTHENIUM. E. J. Rapperport and M. F. Smith. Trans. AIME, 230: 6-11(Feb. 1964).

Phase boundary values of the Ru–W system were determined by electron microprobe analysis and metallographic and x-ray methods. The primary features of the diagram are: a terminal solid solution of Ru in W with a maximum solubility at 23% Ru at 2300°C, and of W in Ru with a maximum solubility of 48% W at 2205°C, as sigma phase of maximum breadth about 6% based on the composition W_3Ru_2, which forms peritectically from the melt at 2300°C, and which decomposes eutectoidally at 1667°C to form alpha W and beta Ru; and a eutectic at 45% Ru and 2205°C with the products being alpha plus beta Ru. (auth)

26046 EFFECTS OF SINTERING ON THE PHYSICAL AND MECHANICAL PROPERTIES OF ARC PLASMA-SPRAYED TUNGSTEN. W. A. Spitzig and G. W. Form. Trans. AIME, 230: 67-70(Feb. 1964).

The effects of hydrogen and vacuum sintering treatments on the physical and mechanical properties of arc plasma-sprayed tungsten were investigated. Temperatures examined ranged from 3000 to 4000°F in vacuum and 2000 to 3000°F in hydrogen for both single and duplex sintering cycles. The results of the investigation point out the desirability of using a low-temperature long-time hydrogen treatment prior to a high-temperature vacuum sinter for arc plasma-sprayed tungsten. (Rev. Metal Lit., 21: No. 4, April 1964)

26047 HOMOGENIZATION KINETICS OF A SINTERED COLUMBIUM ALLOY. S. Leber and R. F. Hehemann. Trans. AIME, 230: 100-6(Feb. 1964).

An investigation on the kinetics of alloying in a (Nb–15% W, 5% Mo, 1% Zr) powder-metallurgy alloy are described. The degree of homogeneity obtained in hydrostatically pressed and vacuum-sintered samples is described by composition distributions resulting from analysis of x-ray-diffraction line profiles. Sintering variables and degree of powder dispersion were evaluated. (Rev. Metal Lit., 24: No. 4, April 1964)

26048 THE CONSTITUTION DIAGRAM TANTALUM–RHODIUM. Bill C. Giessen, Hanna Ibach, and Nicholas J. Grant. Trans AIME, 230: 113-22(Feb. 1964).

The system Rh–Ta was investigated over the entire composition range using metallographic and x-ray techniques as well as thermal analysis. Terminal solubility limits, solidus temperatures, and the crystal structures of two new intermediate phases were determined. (auth)

26049 PRISMATIC SLIP IN ZONE-REFINED BERYLLIUM. E. D. Levine, D. F. Kaufman, and L. R. Aronin. Trans. AIME, 230: 260(Feb. 1964).

The purity of zone-refined Be single crystals was determined by electrical resistivity measurements at 4.2 and 298°K. The purity dependence of the critical shear stresses for basal and prismatic slip was then studied. (Rev. Metal Lit., 24: No. 4, April 1964)

26050 DIFFUSION OF OXYGEN AND NITROGEN BETWEEN SPECIAL INTERSTITIAL SITES IN SOLID SOLUTION IN YTTERBIUM. George Mah and Charles Wert (Univ. of Illinois, Urbana). Trans. Met. Soc. AIME, 230: 16-19(Feb. 1964).

Internal-friction peaks caused by diffusion of O and N were observed in Yb. They are thought to be caused by the redistribution, under stress, of strain dipoles around an interstitial O or N and a neighboring substitional impurity. With the use of a simple geometrical model, diffusion coefficients for O and N between special interstitial sites were calculated. (auth)

26051 SELF-DIFFUSION OF SILVER IN BETA–AgMg. H. A. Domian and H. I. Aaronson (Ford Motor Co., Dearborn, Mich.). Trans. Met. Soc. AIME, 230: 44-57(Feb. 1964).

The self-diffusivity of ^{110}Ag was measured as a function of temperature and composition in β AgMg, a CsCl-type intermetallic compound with a substitutional defect structure on both sides of the stoichiometric (50 at. % Mg) composition. The measurements show that ln D increases linearly, and both ln D_0 and Q decrease linearly with deviation from stoichiometry. The slopes of the lines are significantly steeper in Mg-rich alloys. Equations for the variation of Q with composition were derived by application of the theory of random walk processes on the assumption that diffusion in compounds of this type takes place by the six-jump cycle mechanism. The favorable agreement obtained with experiment furnishes fresh support for the correctness of this assumption. A principal result of this treatment is that, although the concentration of vacancies is considerably higher in the Ag sublattice than in the Mg sublattice, the activation energies for movement of the Mg sublattice vacancies are so much lower that these vacancies are responsible for effectively all diffusion of Ag in this compound. A tendency for vacancies of both types to be kinetically bound to wrong atoms is also noted. (auth)

26052 HOMOGENIZATION KINETICS OF A SINTERED COLUMBIUM ALLOY. S. Leber (General Electric Co., Cleveland) and R. F. Hehemann. Trans. Met. Soc. AIME, 230: 100-6(Feb. 1964).

The kinetics of alloying in a (Nb–15 wt % W, 5 wt % Mo, 1 wt % Zr) powder metallurgy alloys are described. The degree of homogeneity obtained in hydrostatically pressed and vacuum-sintered samples is described by composition distributions resulting from analysis of x-ray-diffraction line profiles. Sintering variables and degree of powder dispersion were evaluated. The utility of single-value parameters obtained from composition distributions is dis-

cussed. The spatial distribution of composition, as revealed by anodically tinted metallographic samples, was used to provide diffusion models based on a concentric-sphere geometry. Diffusion equations developed from the models were found to be in general agreement with experimental results. (auth)

26053 THE SYSTEM TANTALUM–TITANIUM–ZIRCONIUM–OXYGEN AT 1500°C. Michael Hoch and Daniel B. Butrymowicz (Univ. of Cincinnati). Trans. Met. Soc. AIME, 230: 186-92(Feb. 1964).

The isothermal section of the Ta–Ti–Zr–O system at 1500°C was investigated using x-ray-diffraction and metallographic techniques. Up to 71.4 at. % O, the system contains nine four-phase regions. Isopleths at 10, 20, 30, 40, 50, and 60 at. % O were constructed. (auth)

26054 FIELD-EMISSION MICROSCOPY OF METAL CRYSTAL NUCLEATION. K. L. Moazed (Ohio State Univ., Columbus) and G. M. Pound. Trans. Met. Soc. AIME, 230: 234-9(Feb. 1964).

An investigation was made of the deposition of Ag from a thermal beam onto W field-emitter tips at 300°K. Island-type nuclei were observed to form and grow. The nucleation of Ag crystals occurs preferentially on non-close-packed planes of a W tip at a critical volume free-energy change of about −2900 cal/cc. The adatom population, which is critical for appreciable nucleation rate of Ag crystals, is about 0.2 of a monolayer and is essentially independent of beam flux, time, and source temperature. This result is strong evidence that a metastable equilibrium exists between adatoms and critical nuclei, as assumed in the present theory. (auth)

26055 PHASE TRANSFORMATIONS IN SOLID SOLUTIONS OF VANADIUM–TANTALUM ALLOYS. A. P. Nefedov, E. M. Sokolovskaya, A. T. Grigor'ev, I. G. Sokolova, and N. A. Nedumov. Zh. Neorgan. Khim., 9: 883-9(Apr. 1964). (In Russian)

Microscopic, microhardness, hardness, high-temperature, electric conductivity, and x-ray analyses were made of V–Ta alloys. At temperatures above 1300°C, V–Ta alloys form continuous solid solutions. Intermediate phase V_2Ta is formed at 1300 ± 10° with homogeneity at 900° and 32 to 39 at.% Ta concentrations. The two-phase region ($\alpha + V_2Ta$, $V_2Ta + \beta$) was found with 9 to 52 at.% Ta at 900°. (R.V.J.)

26056 NIOBIUM–MOLYBDENUM–ZIRCONIUM ALLOYS. I. A. Popov and N. G. Rodionova. Zh. Neorgan. Khim., 9: 890-9(Apr. 1964). (In Russian)

Microstructures of ternary Mo–Nb–Zr alloys and binary Mo–Zr alloys annealed at 1400°C were analyzed and compared. A constitution diagram of Mo–Nb–Zr alloys was constructed with isothermal cross section at 1400°C. The melting diagram of Mo–Nb–Zr alloy was studied and solidus surface was constructed. The heat resistance of the Mo–Nb–Zr alloy was studied at 800° and it was found that the alloys with 30 to 70% Zr and not over 10% Mo formed a highly adhering oxide coating. (R.V.J.)

26057 ELECTROLYTIC DEPOSITION OF NICKEL WITH NIOBIUM, TANTALUM, TITANIUM, AND ZIRCONIUM FROM ANHYDROUS SOLUTIONS. M. M. Godneva. Zh. Neorgan. Khim., 9: 996-1001(Apr. 1964). (In Russian)

Electrolysis of anhydrous solutions of $NiCl_2$ and $NbCl_5$ (in various organic solvents) and of $TaCl_5$, $TiCl_4$, $ZrCl_4$, and $ZrOCl_2 \cdot 8H_2O$ (in methyl and ethyl alcohols) was investigated. Certain anhydrous solutions formed nickel and cobalt coatings. Niobium, tantalum, titanium, and zirconium did not form any coatings. It was found that Nb, Ti, and Ta co-precipitate with nickel from $NbCl_5$, $TiCl_4$, and $ZrCl_4$ in ethyl, propyl, and butyl alcohols in the presence of nickel at 0.1 to 0.3 amp/cm^2. It was observed that neither Zr nor Ni precipitate from a $ZrOCl_2 \cdot 8H_2O$–$NiCl_2$–C_2H_5OH bath; however, with a small addition of niobium pentachloride, the Zr, Nb, and Ni are freely precipitated. (R.V.J.)

26058 NEW CERAMICS AND REFRACTORIES. J. White (Sheffield Univ., Eng.). Paper No. 726 of "Advances in Materials. Inter-Disciplinary Symposium, Fifth and Sixth Sessions, 8 April, 1964." London, The Institution of Chemical Engineers, 1964. 34p.

Conventional uses of ceramic materials are such as to utilize hardness, compressive strength, corrosion resistance, and heat resistance to maximum advantage, while discounting to a considerable extent their brittleness, low thermal shock, and unreliability under tensile stress. Any major extension in the engineering uses of ceramics will depend on the degree to which these latter weaknesses can be eliminated. In recent years a comsiderable research effort was expended with this end in view and it is intended to discuss the progress that was made both toward achieving a better understanding of the failure mechanisms involved and toward the development of new or improved ceramics. Under the latter heading developments in the fields of oxide and non-oxide ceramics, cermets, and refractories are described. (auth)

26059 ADVANCES IN NUCLEAR CERAMICS. F. J. P. Clarke and P. Murray (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.25-42 of "Advances in Materials. Inter-Disciplinary Symposium, Fifth and Sixth Sessions, 8 April, 1964." London, The Institution of Chemical Engineers, 1964.

The development of nuclear ceramic fuels offers economic advantages compared with metallic systems; these arise not only from the increased lifetime in power reactors but also from their ability to operate at higher temperatures thus enabling higher thermal efficiency and lower generating costs to be obtained. To achieve these objectives relatively small improvements over established technology are required. Nevertheless appreciable research and development effort was necessary and several examples are given of the way in which investigations on sintering and microstructure led to these developments. Reference is made to the importance of the long term research proceeding on the fundamental properties such as brittleness and thermal shock of ceramic materials in general. If these disadvantages could be overcome, then dramatic advances would be possible leading to the wider application of these materials. (auth)

26060 CHEMICAL ASPECTS OF NUCLEAR CERAMIC DEVELOPMENT. L. E. J. Roberts (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.43-64 of "Advances in Materials. Inter-Disciplinary Symposium, Fifth and Sixth Sessions, 8 April, 1964." London, The Institution of Chemical Engineers, 1964.

The development of high melting compounds for nuclear fuels is discussed, and aspects of chemical research are stressed. (auth)

26061 THE COUNTER DIFFUSION OF GASES IN NUCLEAR GRAPHITE. T. R. Jenkins, F. Roberts, and J. B. Morris (Atomic Energy Research Establishment, Harwell,

Berks, Eng.). p.83-120 of "Advances in Materials. Inter-Disciplinary Symposium, Fifth and Sixth Sessions, 8 April, 1964." London, The Institution of Chemical Engineers, 1964.

Graphite is a well known refractory with excellent machining properties, good thermal and electrical conductivity, and moderately high strength at elevated temperatures. The use of graphite as both moderator and fuel cladding material to contain the radioactive fission products, notably the gases, and thus prevent contamination of the surrounding coolant gas is considered. The high temperature properties of graphite and its low neutron capture cross section make it one of the few materials suitable for this purpose. However, the conventional process for manufacturing graphite always produces a porous material. The pore properties of a graphite suitable for cladding fuel in the high temperature reactor must be such as to allow efficient back-sweeping of the radioactive fission product gases by a small overpressure of coolant gas, thus preventing the escape of radioactive fission gases into the main coolant stream. In order to study this problem the counter diffusion of gases through the pores of various graphites was examined using the system helium/nitrogen, and the results were analyzed by an equation based on normal gas-in-gas diffusion and a capillary model with frequently-linked pores. An attempt was made to correlate the diffusion coefficients with more easily measured pore parameters, viz, the permeability coefficients and pore size data. (auth)

26062 VAPOR PRESSURES OF THE RARE EARTH METALS. Clarence Edward Habermann. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 122p.

Vapor pressure measurements on the rare earth metals were made by the Knudsen effusion technique in conjunction with a quartz-fiber microbalance over a pressure range of 10^{-1} to 10^{-3} mm of Hg. The material used was specially prepared in order to reduce impurity effects to a minimum. Ytterbium is the most volatile of the rare earth metals, while lanthanum and cerium are the least volatile. The data were fitted to a straight line by the least squares method and the heats of vaporization or sublimation were calculated from the slope of the line. The heats of sublimation at 298°K were then calculated using the best available data for the enthalpies of the condensed and vapor states. For nine of the elements, measured heat content and entropy data for the condensed state as well as calculated free energy functions for the gaseous state were available, permitting a third law calculation of ΔH°_{298} using the measured vapor pressure data. The second and third law methods were generally in good agreement, but a comparison of the present work and previous investigations revealed several differences amounting to as much as 15 kcal/mole in the case of gadolinium. A possible explanation for the variations in the cohesive energies of the different rare earth metals, based on the differences in the electronic structures of the gaseous atoms, and the number of d-electrons present in the condensed structure, was presented. A portion of each vapor pressure run was made over a pressure region where the ratio of the mean free path to orifice diameter was less than 10, which was the lower limit suggested by Knudsen for free molecular flow. From the present evidence, the limit of unity for this ratio used by several recent investigators seems to be more realistic. (Dissertation Abstr.)

26063 DISLOCATION STRUCTURES IN MOLYBDENUM AND MOLYBDENUM–RHENIUM ALLOYS. Keiichi Ogawa. Thesis, Philadelphia, Univ. of Pennsylvania, 1963. 200p.

Zone-refined molybdenum and zone-leveled molybdenum–rhenium alloys were cold-rolled; the sheets thus produced were annealed to eliminate the deformation structure. The well-annealed specimen, which contains only well-defined sub-boundaries, was pulled either at room temperature or at liquid nitrogen temperature. The strained specimens were electro-polished in concentrated sulfuric acid. Annealing at 1300°C for about 5 min was found to be sufficient to result in nearly dislocation free grains with well-defined sub-boundaries except for Mo–35 at. % Re alloy. The Mo–35 at. % Re alloy was found to have a Widmanstätten structure owing to σ-phase precipitation. The crystallographic relationship between the matrix and the σ-phase was determined with the aid of electron-diffraction patterns; these are $(110)_{matrix} \parallel (100)_{\sigma\text{-phase}}$, $[100]_{matrix} \parallel [100]_{\sigma\text{-phase}}$. Annealing followed by rapid cooling was adequate to suppress σ-phase precipitation. No change in dislocation structures was observed in the deformed low rhenium content alloys: dislocations start to tangle at an early stage of deformation (0.1% strain). Deformation seems to disturb sub-boundaries and precipitates (possibly carbon) were found to be surrounded by dislocations in the deformed specimens. A profuse amount of twins was observed in the Mo-35 at. % Re alloy at room temperature and in the Mo–18 at. % Re alloy deformed at liquid nitrogen temperature. A dislocation reaction between a slip dislocation and three twinning dislocations was frequently noted and this reaction appears to be related to the nucleation of twins. Twins were found to contain a number of slip dislocations which seem to lie on slip planes. Neither extended dislocations nor extended dislocation nodes were observed throughout the present investigation. From these observations it is concluded that: i) Solution hardening observed in Mo–Re alloys must not be strongly related to stacking faults (Suzuki effect), ii) Dislocations are multiplied in the regions where pre-existing dislocations (i.e., dislocations which exist before deformation) are available, iii) Stacking fault energy has little to do with twinning, and iv) Nucleation of twinning is related to the dislocation reaction between a slip dislocation and three twinning dislocations. Based on the observed dislocation reaction between a slip dislocation and three twinning dislocations, a twinning mechanism has been proposed. This model suggests that the main barrier for the nucleation is a strong attractive interaction between the three twinning dislocations and the resultant emissary set. Once this barrier has been surmounted possibly with the aid of local stress concentration, the three twinning dislocations will propagate favorably owing to the repulsive interaction force between two sets of dislocations as well as the applied stress. The twin nuclei thus produced are considered to grow by collecting slip dislocations. This model is able to explain i) why twins grow catastrophically at low temperatures (where dislocations are considered to have poor mobility), ii) the results of the present observations show no strong connection between the initiation of twinning and stacking fault energy, but do show a close relation of a slip dislocation to three twinning dislocations, iii) the results further indicate a low temperature dependence of twinning stress and an alloying element effect. (Dissertation Abstr.)

26064 PLENUM PRESS HANDBOOKS OF HIGH-TEMPERATURE MATERIALS. NO. 2. PROPERTIES INDEX. G. V. Samsonov. Authorized Translation from the Russian. New York, Plenum Press, 1964. 428p. $22.50.

Information is included on stoichiometry and crystal chemistry and thermal and thermodynamic, electrical and magnetic, optical, mechanical, chemical, and refractory properties. The application of refractory compounds is also discussed, and phase diagrams of some binary systems are appended. 1337 references are included. (P.C.H.)

26065 A THERMODYNAMIC STUDY OF THE ZIRCONIUM–SULFUR SYSTEM IN THE REGION $ZrS_{1.49}$ TO $ZrS_{2.00}$. A. H. Larson and A. W. Schlechten (Colorado School of Mines, Golden). 23p. (CONF-524-2)

From American Institute of Mining, Metallurgical and Petroleum Engineers Annual Meeting, New York, Feb. 1964.

Equilibrium H_2S/H_2 ratios were determined as functions of temperature (500 to 900°C) and composition in a hydrogen circulation apparatus. Within the composition range studied there exists a two-phase region of Zr_3S_4 and ZrS_2. The upper composition limit of the two-phase region is bounded by a disulfide phase and is practically constant over the temperature range investigated. The lower composition limit of the two-phase region is bounded by a Zr_3S_4 phase and varies appreciably with temperature. The upper composition limit of the homogeneous region of the disulfide phase was not definitely determined, but it appears to be bounded by the stoichiometric composition of ZrS_2. The lower composition limit of the homogeneous region of the Zr_3S_4 phase could not be determined due to the extremely low values of the equilibrium H_2S/H_2 ratios. Various thermodynamic quantities are evaluated from the data. (auth)

26066 IMPROVEMENTS IN OR RELATING TO MAGNESIUM BASE ALLOYS. Philip Andrew Fisher (to Magnesium Elektron Ltd.). British Patent 960,027. June 10, 1964. Filed Apr. 27, 1962.

A Mg base alloy is described which has excellent creep resistance at elevated temperatures even without heat treatment. The alloy contains nominally 1% (0.7 to 1.2) Al and 0.7% (0.6 to 0.9) Mn. Data are given on the creep properties of the alloy at 400 and 500°C under stresses of 150 to 300 psi. (D.L.C.)

Radiation Effects

26067 (AI-8971) RADIATION EFFECTS ON ELECTRODE BEHAVIOR. Midpoint Report, June 1–August 31, 1963. G. R. Argue, H. L. Recht, and W. A. McCollum (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Sept. 1963. Revised Oct. 14, 1963. For California Inst. of Tech., Pasadena. Jet Propulsion Lab. Contract NAS7-100. 25p. (NASA-CR-55217; N64-13187)

Laboratory experiments were carried out to determine the capacity, elevated temperature characteristics, and general electrochemical behavior of 2-electrode cells under various current cycling regimes. These cells used electrodes taken from Ni–Cd cells. Gamma irradiation runs have been carried out at a ^{60}Co source (dose rate = 1.9×16^6 rads/hr) and at a second ^{60}Co source (dr = 8×10^4 rads/hr). A small deterioration in output voltage with time (of the order of tens of millivolts) was observed at dosages of 10^8 rads, but the results were clouded by having to correct for the effects of a simultaneous high temperature produced in the source to obtain this figure. Sloughing off of electrode material, almost entirely from the cadmium (negative) electrode became apparent at about 6×10^6 rads. At 1.3×10^7 rads, or some lesser figure, the capacity of the cadmium electrode is drastically reduced. (auth)

26068 (ANL-6799) A SHIELDED ENCLOSURE FOR NEUTRON RADIOGRAPHIC INSPECTION OF ENCAPSULATED, IRRADIATED SPECIMENS. W. N. Beck and H. Berger (Argonne National Lab., Ill.). Mar. 1964. Contract W-31-109-eng-38. 12p.

A neutron shield enclosure for neutron radiographic inspection of encapsulated, irradiated fuel specimens was fabricated. An existing shielded cask was modified to handle a complete irradiation experiment from the CP-5 reactor. The inspection technique makes use of a potentially radioactive screen to detect the neutron imaging beam after it has passed through the inspection object. The radioactive image on the screen is made visible by allowing it to decay in close contact with photographic film. Contrast resolution of the system is 0.76 mm (0.030 in.) or better. Contrast sensitivity is in the order of 1 to 2 percent. (auth)

26069 (ANL-6868(p.373-417)) IRRADIATION EFFECTS. (Argonne National Lab., Ill.).

Radiation effects on crystals are studied both experimentally and theoretically. Fission track formation in aluminum oxide crystals is discussed. Radiation damage in copper, silver, gold, aluminum-copper alloy, and aluminum-zinc alloy crystals is evaluated. Swelling of uranium during post-irradiation annealing is studied with respects to the effects of grain size and burnup. The diffusion of fission bubbles in solids is theoretically evaluated along with coalescence and migration of pores in solids. Point defect clustering in irradiated and quenched crystals is discussed in relation to the effects of annealing. Zone formation in crystalline aluminum alloys is analyzed. (N.W.R.)

26070 (BNL-7979) GRAPE—A COMPUTER PROGRAM FOR CLASSICAL MANY-BODY PROBLEMS IN RADIATION DAMAGE. Arlene Larsen (Brookhaven National Lab., Upton, N. Y.). Jan. 1964. Contract AT-30-2-GEN-16. 283p.

GRAPE is a series of 7090/7094 programs, FORTRAN and FAP, for solving the classical equations of motion of a large set of particles. The primary purpose is to simulate the motion of atoms in a crystal. Part I sets up the crystal configuration, calculates entries for various tables needed in other parts, and saves this information on a binary tape. Part II integrates the classical equations of motion, checks that energy conservation laws have held, and writes information on a binary tape. Part III edits the binary tape for desired information, performs additional calculations as needed, and writes output. Part IV contains utility routines for manipulating and identifying tapes and making some ancillary calculations. For solving the equations of motion a fast search technique was developed to locate position coordinates of interacting particles. By this technique the search time is a linear function of the number of particles in the crystal. (auth)

26071 (NASA-TN-D-2329) VISIBLE RADIATION DAMAGE EFFECTS OF 40-Mev ALPHA PARTICLES ON SODIUM CHLORIDE CRYSTALS. Michael Hacskaylo and C. C. Giamati (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). June 1964. 13p.

The bombardment of sodium chloride crystals with high fluxes ($>10^{14}$ particles/cm^2) of 40-Mev alpha particles, whose computed range is 0.72 millimeter, produces a damaged planar region normal to the alpha beam near the

end of the range. The irradiated crystals are colored throughout the portion between the incident surface and a plane parallel to this surface at a depth of 0.73 ± 0.01 millimeter. The damaged region is characterized by (1) a line of discontinuity of the surface cleavage pattern at the coloration limit on surfaces parallel to the beam, (2) a plane of "easy" cleavage at various depths between 0.43 and 0.62 millimeter, and (3) crystallographic cavities that appear after the crystals are heated to 400°C. These cavities form in planes at the coloration limit, at the easy cleavage plane, and sometimes in planes at slightly shallower depths. The heating suffices to bleach completely the F-centers produced by the irradiation, and, during this time, the helium gas from the stopped alpha particles escapes from the crystals. Chemical analyses show that some "free" chlorine and "free" sodium atoms are present in the irradiated colored crystals, but that the irradiated bleached crystals contain no free chlorine or sodium. (auth)

26072 (VDDIT-16(4.2)) RADIATION EFFECTS ON SOLID, URANIUM-BASED NUCLEAR FUEL MATERIALS. VOLUME 4, NUMBER 2. A Bibliography. W. Uhlmann (Aktiebolaget Atomenergi, Stockholm). Apr. 1964. 34p.

Sixty abstracts of references on radiation effects on solid, uranium-based nuclear fuel materials are presented. A coordinate subject index, author index, report number index, and journal index are included. (M.C.G.)

26073 (WAPD-246) IN-PILE EFFECTIVE THERMAL CONDUCTIVITY OF OXIDE FUEL ELEMENTS TO HIGH FISSION DEPLETIONS. R. C. Daniel and I. Cohen (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Apr. 1964. Contract AT-11-1-GEN-14. 151p.

Below 10^{19} fissions/cc at approximately 500°C, the initial effective thermal conductivities of pressure-bonded elements were measured in-pile as 0.035, 0.0165, and 0.021 watts/cm-°C for UO_2, ZrO_2 + 34 wt % UO_2, and ZrO_2 + 46 wt % UO_2, respectively. After 25×10^{20} fissions/cc, these values had decreased 50, 25, and 35 percent, respectively. Comparison of the initial values with unirradiated bulk fuel conductivities indicates that the contact conductance with the surrounding nickel capsule was consistent with out-of-pile data for UO_2 but was essentially infinite for the ZrO_2 + UO_2 fuels which exhibit higher in-pile plasticity. (auth)

26074 THE EFFECT OF NEUTRON IRRADIATION ON THE STRENGTH OF αCu–Al SINGLE CRYSTALS. T. J. Koppenaal (Argonne National Lab., Ill.). Acta Met., 12: 487-93(May 1964).

The room temperature strength of Cu and αCu–Al single crystals containing 0.5 to 14 at. % Al was studied as a function of neutron irradiation from doses of 1.0×10^{15} to 0.98×10^{20} nvt. For a dose of 1.4×10^{17} nvt or less, the amount of irradiation-induced strengthening decreases with increasing solute concentrations; the strength of Cu–14 at. % Al crystals is independent of dose in this range. With dose of 0.94×10^{18} nvt or more, the strength of the crystals is independent of solute concentration. These observations are explained on the basis of solute additions increasing the dislocation motion stress and neutron irradiation increasing the dislocation generation stress. The Cu data follow the cube-root dose dependence previously established by others; the irradiated alloy crystals show the same macroscopic glide characteristics as was found in irradiated Cu single crystals. Measurements of both the difference in the flow stress between 77 and 300°K and the strain rate dependence of the flow stress at 300°K become solute independent at a dose of 0.94×10^{18} nvt; saturation effects are found in both these properties at a dose of 0.98×10^{20} nvt. (auth)

26075 ACCUMULATION OF RADIATION DAMAGE IN METASTABLE β-PHASE PLUTONIUM. E. King (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Cryogenics, 4: 108-9(Apr. 1964).

The β-phase was retained in two samples of high-purity plutonium by quenching from ~425°K directly into liquid nitrogen. The samples were then transferred into liquid helium. One sample was held at ~5°K, while the other was periodically heated to ~25°K. The increase in electrical resistivity with time and temperature was observed, and annealing of the accumulated resistivity was studied. The additional resistivity due to radiation self-damage proved highly dependent on temperature. Observations were also made on a sample held in liquid nitrogen. (D.C.W.)

26076 STABILITY OF RADIOPHOTOLUMINESCENCE IN METAPHOSPHATE GLASS. J. S. Cheka (Oak Ridge National Lab., Tenn.). Health Phys., 10: 303-14(May 1964).

A study was made of the stability over a period of a year of radiophotoluminescence in metaphosphate glass microdosimeters in dark storage. The exposures ranged from 100 r to 100 kr. The three types of glass studied included a high atomic number glass, and two of lower atomic number. At moderate exposures the fluorescence output of the high Z-glass decreased monotonically with time, while that of the low Z-types increased slightly at first then decreased, but remained within 10% of the 24 hr readings throughout the period. At high exposures, where discoloration occurred, the decrease in ultraviolet opacity perturbed this pattern. Direct sunlight was found to produce a significant decrease in fluorescence. (auth)

26077 RADIATION EFFECTS ON INSULATION—STATE OF THE ART. V. J. Linnenbom. Insulation [Libertyville], 10: 21-6(Mar. 1964).

Recent developments in the study of radiation effects on insulation are reviewed. The combined effects of radiation and environmental conditions on insulating properties are considered; high temperature and radiation effects, low temperature and radiation effects, and low pressure and radiation effects are discussed. Transient effects of radiation including increase in conductivity and transient behavior in components are described. The contribution of radiation effects data on materials and components to circuit design is dealt with and some beneficial aspects of radiation are outlined. (auth)

26078 EFFECTS OF γ RADIATION ON CERTAIN OPTICAL PROPERTIES OF SYNTHETIC RUBY. S. V. Starodubtsev and M. S. Yunusov (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 1, 92-4(1964). (In Russian)

Effects of γ radiation on the optical properties of pink ruby crystals (containing ~2% Cr_2O_3) were studied in relation to their laser properties. The color center, color stability, and discoloration were analyzed as functions of radiation doses. A photomultiplier (FEU-22) and a spectrophotometer (SF-4) were used to determine the optical density for ordinary, extraordinary, and nonpolarized beams. A radiation induced thermoluminescence was examined from room temperature to 500°C. (R.V.J.)

26079 ESR STUDIES OF IRRADIATED ALKALI BORATE GLASSES WITH HIGH ALKALI OXIDE CONTENT. Sook Lee and P. J. Bray (Brown Univ., Providence). J. Chem. Phys., 40: 2982-8(May 15, 1964).

Electron spin resonance (ESR) studies have been made

of γ irradiated alkali borate glasses, containing more than approximately 25 molar % alkali oxide. The alkali borate glasses (Li_2O–, Na_2O–, K_2O–, Rb_2O–, and $Cs_2O-B_2O_3$) exposed to a γ dose of 1×10^8 R display ESR spectra which partially resolved into four major absorption lines at both X- and K-band microwave frequencies. Details of this four-line resonance have been found to depend on the particular alkali oxide used in making the glass. When the glass sample was enriched with the ^{10}B isotope, the observed spectrum exhibited a seven-line resonance instead of four absorption lines. It is concluded that the four- and seven-line structures arise from an isotropic hyperfine interaction of a hole with the ^{11}B and ^{10}B nuclei, respectively. The atom containing the ^{11}B or ^{10}B nucleus is believed to be in a tetrahedral BO_4 configuration in the glass structure. (auth)

26080 A THEORY OF SWELLING AND GAS RELEASE FOR REACTOR MATERIALS. R. S. Barnes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nucl. Mater., 11: 135-48(Feb.-Mar. 1964). (AERE-R-4429)

Physical mechanisms deduced from the direct observation of inert gas bubbles in the electron microscope were used to evolve a model, or theory, for swelling. The model assumes the insolubility of the inert gases and the bodily migration of the gas bubbles, and relies upon the equation of state for the inert gas, upon the surface energy, the surface self-diffusion coefficient, and the lattice parameter of the solid, and upon some internal driving force, which is believed to be related to the line tension of dislocation lines. With values for these parameters and the irradiation and annealing conditions, estimates for the bubble size (r) and number/cm^3 (n) were made. From these the swelling ($\Delta V/V$) can be calculated, but the effect of grain size, grain boundary migration, and other structural features of the solid must be considered. The model was tested against several experimental results from a variety of solids and satisfactory agreement was obtained. The model is thought to be valid for all solids, including nonmetals, and can account for breakaway swelling and gas release. The limitations of the model, which is a very simple one, are discussed. (auth)

26081 ELECTRON MICROSCOPIC TECHNIQUE FOR THE INVESTIGATION OF IRRADIATION DAMAGE TO SMALL NUCLEAR FUEL PARTICLES. L. Moscou (Koninklijke Zwavelzuurfabrieken v/h Ketjen N.V., Amsterdam). J. Nucl. Mater., 11: 243-6(Feb.-Mar. 1964).

An electron microscopic technique for the investigation of irradiation damage to sintered ThO_2-UO_2 fuel particles is described along with some results. The electron microscopic investigation gave a clear picture of the actual damage to the particles. An example is the fact that the debris pieces are considerably smaller than the crystallites of the particle and the pores created by the irradiation. This indicates that peptization or dissolution phenomena are involved. Another interesting observation derived from the electron micrographs is that the fragmentation seems to occur by pore formation more than by superficial attack. The number of pores seems to be orders of magnitude lower than the number of fission fragments passing the surface. (P.C.H.)

26082 DISTRIBUTION OF DISLOCATIONS IN IRRADIATED CRYSTALS. I. G. Berzina and I. B. Berman. Kristallografiya, 9: 260-4(1964).

Studies were made on the microhardness and the distribution of dislocations near the indentor prints on etched faces (100) of irradiated crystals of LiF, NaCl, and KCl. Single crystals were employed in the tests, and each was subjected to bombardment by protons having energies of 5 Mev. The average density of rays was 6×10^{10} protons/cm^2 sec, with a proton current of about 0.2 μa. It was discovered that the dimensions of diagonal rays from the star etch figures declined steadily with irradiation dose. Etching had no substantial effect on the microhardness. It was found that changes in length of the star rays and changes in microhardness of individual crystals correspond to different kinds of defects—length of star rays to point defects and microhardness to more complex defect combinations. (A.I.D. Press, Vol. 2, No. 236, June 1964)

26083 CHANGE IN THE STRUCTURE OF PENTAERYTHRITE WHEN IRRADIATED WITH X-RAYS. E. V. Kolontsova and I. V. Telegina. Kristallografiya, 9: 282-4 (1964).

It was found that the intensity of reflected monochromatic rays from pentaerythrite does not remain constant but increases slightly at first and then declines. The useful lifetime of a crystal, when the intensity of reflection is still rather high and to some degree constant, varies from crystal to crystal, generally ranging from 50 to several thousand hours. The nature of structural change giving rise to this phenomenon was investigated. Irradiation was produced by a BSV-1 tube with Mo anode, a current of 10 ma, and a voltage of 45 kv. Irradiation time ranged from 20 to 950 hr. Laue patterns were photographed to trace the structural changes. These were compared with the patterns of a crystal not subjected to irradiation. A difference began to appear at 40 to 50 hr, and irradiated crystals exhibited increased intensity of diffusion maximums and expansion of the Laue spots. The changes became clearer with prolonged irradiation. After 80 to 100 hr of irradiation, a well-defined asterism appeared on the Laue patterns, a definite indication of separation of the single crystal into separate segments, variously oriented. After about 200 hr, no further reorientation occurred, but the actual time differed for different crystals. It thus appears that the intensity of x-ray reflection weakens because of fragmentation in the crystal through irradiation. Decrease in intensity of reflection is due also to radiation defects in the fragments themselves. It was concluded that point defects arise because of the irradiation, and, when the concentration of defects is considerable and their mobility high, they form stable complexes. Changes in the form and size of these complexes at different stages of irradiation explain the changes in intensity of diffusion maximums, the loss of transparency, and the lamination of strongly irradiated crystals. Fragmentation may be related to the collapse of these accumulations (complexes) at some definite stage of irradiation and to the formation of dislocation loops, which are free to generate dislocations under proper conditions. (A.I.D. Press, Vol. 2, No. 237, June 1964)

26084 OPTICAL BLEACHING OF V_3 CENTERS IN KCl. T. P. Zaleskiewicz and R. W. Christy (Dartmouth Coll., Hanover, N. H.). Phys. Rev., 135: A194-9(July 6, 1964).

Bleaching of V_3 centers by uv light absorbed in the V_3 band was studied in Harshaw KCl crystals which had been x-ray irradiated at room temperature. The bleaching measurements were made in the temperature range from 75 to 110°C, where the uv bleaching rate was appreciable but purely thermal bleaching (in the dark) was not significant. The V_3 band decay was approximately exponential in

time. Furthermore, the decay constant was approximately an exponential function of inverse temperature, with an activation energy of 0.6 ev. The calculated quantum efficiency for the bleaching was small throughout this temperature range, being given by $\eta \approx 10^6 \exp(-0.6 \text{ ev/kT})$. Some interaction between V_3 centers and F centers was observed, since bleaching of either band by light absorbed in the band led to partial bleaching of the other band. The results are interpreted in terms of a model for the V_3 center consisting of a Cl_3^- molecular ion at a cation vacancy. The V_3-band bleaching differs from U-band bleaching in its strong temperature dependence and the lack of any accompanying F-band production. (auth)

26085 INFLUENCE OF COLD WORK AND RADIATION DAMAGE ON THE ANGULAR CORRELATION OF GAMMA RAYS FROM In^{111} NUCLEI IMBEDDED IN SILVER. George W. Hinman, Gilbert R. Hoy, Joseph K. Lees, and John C. Serio (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev., 135: A218-20(July 6, 1964).

Measurements were made to determine the effect of cold work and radiation damage on the angular correlation of gamma rays in the decay of ^{111}In nuclei in silver. The correlation for well-annealed silver samples is also discussed. It is concluded that there is only slight attenuation in well-annealed pure silver specimens. Furthermore, both radiation damage and cold work influence the correlation. (auth)

26086 COLOR CENTER PRODUCTION IN CaF_2Sm^{3+} (Y^{3+}) BY ULTRAVIOLET IRRADIATION. T. Ewanizky (Army Electronics Labs., Fort Monmouth, N. J.). Phys. Rev., 135: A221-3(July 6, 1964).

Color centers were produced in certain CaF_2Sm^{3+} crystals by ultraviolet irradiation. The color centers are attributed to reduction of Y^{3+} impurities. Although no Sm^{3+} reduction was observed, its presence was found to be indispensable for ultraviolet coloration. A complex is proposed, within which charge transfer takes place. (auth)

26087 F-AGGREGATE COLOR CENTERS IN KCl. S. Schnatterly and W. Dale Compton (Univ. of Illinois, Urbana). Phys. Rev., 135: A227-32(July 6, 1964).

The equilibrium established between F and F-aggregate centers in KCl by x rays was studied at room temperature. It was found that the concentration of R centers was proportional to the product of the concentration of F and M centers, indicating that the R centers are composed of three F centers. The concentration of N_2 centers was proportional to the product of the concentration of F and R centers, suggesting that the N_2 center is composed of four F centers. The concentration of N_1 centers was proportional to the concentration of M centers, suggesting that the N_1 center is composed of two F centers. The deviation from linearity of the N_F^2 versus N_M curve is shown to arise from the presence of higher aggregate centers. Samples x irradiated at room temperature to establish an equilibrium among F and F-aggregated centers were cooled and the irradiation continued. The concentration of M centers decreased exponentially with irradiation time. The temperature dependence of this exponential decay time corresponded to an activation energy of 0.07 ev for temperatures above 100°K. (auth)

26088 PRODUCTION OF DEFECTS IN CADMIUM SULPHIDE BY ^{60}Co GAMMA RAYS. G. F. J. Garlick, F. J. Bryant, and A. F. J. Cox (Univ. of Hull, Eng.). Proc. Phys. Soc. (London), 83: 967-70(June 1964).

Marked changes in the infrared emission bands of cadmium sulfide phosphors were observed after irradiation with ^{60}Co gamma rays. The computed number of displaced atoms by direct production of defects from the ordered lattice is much smaller than for electron bombardment experiments and suggests a Seitz mechanism for defect formation. (auth)

26089 NATURE OF LOCALIZED CENTERS WITH DEEP-LYING ENERGY LEVELS IN HIGH-ENERGY ELECTRON-IRRADIATED SILICON. V. D. Tkachev, A. F. Plotnikov, and V. S. Vavilov (Lebedev Inst. of Physics and Tech., Moscow). Soviet Phys.-Solid State (English Transl.), 5: 2333-7(May 1964). Translated from Fiz. Tverd. Tela, 5: 3188-94(Nov. 1963).

On the basis of an analysis of the photoconductivity of silicon single crystals doped with copper and gold which were irradiated by high-energy electrons, it is hypothesized that, as a result of the interaction of simple atomic defects with the impurity atoms, the latter become electrically active centers. Irradiation by fast electrons can be used as a method of detecting certain impurities that are present in small concentrations. (auth)

26090 ANISOTROPIC EFFECT OF IRRADIATION ON DEFORMATION OF ZINC SINGLE CRYSTALS. O. A. Troitskii (Inst. of Physical Chemistry, Academy of Sciences, USSR). Soviet Phys.-Cryst. (English Transl.), 8: 726-30(May-June 1964). (Translated from Kristallografiya, 8: 906-12(Nov.-Dec. 1963).

The anisotropic effects of radiation on the process of deformation of zinc single crystals stretched at a constant rate under proton, gamma, and electron bombardment were investigated. Under optimum conditions, the radiation, orientated along the glide elements {0001}, causes dynamic facilitation of the gliding. It was found that the anisotropy of the radiation effect increases with decreasing speed of deformation under irradiation and that bombardment by heavy particles is more effective than irradiation by light particles. (auth)

26091 RADIATION DAMAGE TO TRANSISTORS. W. C. Honaker and F. R. Bryant (National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.). Space/Aeron., 39: No. 5, 112-14(May 1963).

The radiation effects of 40- and 440-Mev protons on transistors were investigated. For 40-Mev, the overall variation in gain with integrated proton flux began to reach a limiting value at about 10^{12} protons/cm^2. In general, leakage currents in Ge transistors increased by one or two orders of magnitude. Leakage currents for Si transistors were too low, in some cases, to be measured accurately. The transistors were damaged more at 40 than at 440 Mev, which is consistent with previous results. (P.C.H.)

26092 A THIN-FOIL TRANSMISSION ELECTRON-MICROSCOPIC STUDY OF NEUTRON-IRRADIATED A212B STEEL. A. J. Birkle and W. Rall. Trans. AIME, 230: 156-62(Feb. 1964).

The effect of fast neutron irradiation on the microstructure of a common reactor pressure-vessel steel, A212 Grade B, was studied using thin-foil transmission electron microscopy. The dislocation density of the irradiated material was considerably greater than that of the non-irradiated control material. Annealing studies indicated that dislocations and hardness in the irradiated material annealed out at temperatures between 650 and 800°F. However, the dislocations and hardness in control samples cold-worked to 9 and 70% did not anneal out readily, and a high dislocation density was observed, even after a 1 hr anneal at 850°F. Based on the hypothesis that cluster de-

fects, rather than the increased dislocation density, are primarily responsible for radioinduced embrittlement, recommendations are made for reducing the susceptibility to such embrittlement. (auth)

26093 HYDROGEN IN PROTON-BOMBARDED BERYLLIUM: AGGLOMERATION AND DIFFUSION. J. P. Pemsler and E. J. Rapperport (Kennecott Copper Corp., Lexington, Mass.). Trans. Met. Soc. AIME, 230: 90-4(Feb. 1964).

Proton irradiation of high-purity distilled Be was utilized to introduce various H contents from 0.00075 to 0.075 at. % (0.83 to 83 ppm) in a band 0.004-cm wide. After irradiation, the specimens were heat-treated to effect H agglomeration. Observations of agglomerates in all specimens of the lowest H content indicate a H solubility of less than 0.83 ppm in the temperature range 350 to 1050°C. Estimates of the interdiffusion coefficient in the H solid solution of Be were obtained from measurements of the dimensions of H-depleted zones surrounding agglomerated bubbles. A value of (approximately) 3×10^{-9} cm^2/sec was obtained for the diffusion coefficient at 850 to 900°C. (auth)

26094 ANNEALING OF RADIATION-INDUCED DEFECTS IN POLYCRYSTALLINE BISMUTH. Mattackal Kuruvilla Verghese. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 111p.

A study was made on the kinetics of annealing of radiation-induced point defects by their migration to the grain boundaries. A simple mathematical analysis based on a model which assumes the grain boundaries to be unfillable and perfectly absorbing sinks shows that the rate of annealing of defects by the process should be directly proportional to the number of grains per unit surface area except when the force of attraction due to the stress field around the grain boundaries is of long range. An irradiation study of a single crystal and five polycrystalline samples of bismuth with a wide range of grain size was conducted in the UTR-10 reactor. The change of electrical resistivity of the specimens was measured during the irradiation and also during subsequent annealing at two different temperatures. An analysis of the data showed mainly two annealing components and their rates of annealing were found to vary linearly with the number of grain boundaries per unit area which is in conformity with the theoretical predictions. The strict linearity of this relation seems to point out that there is no far-reaching attractive force exerted by large angle grain boundaries. The activation energy for the two components was found to be nearly the same and was about 0.35 ev in magnitude which suggests movement of clustered defects. (Dissertation Abstr.)

26095 IMPROVED GRAPHITE FOR NUCLEAR REACTORS. J. M. Hutcheon (United Kingdom Atomic Energy Authority, Culcheth, Lancs, Eng.). p.65-82 of "Advances in Materials. Inter-Disciplinary Symposium, Fifth and Sixth Sessions, 8 April, 1964." London, The Institution of Chemical Engineers, 1964.

In nuclear reactors moderated with graphite and cooled with carbon dioxide the graphite suffers displacement of atoms from the lattice by fast neutrons and chemical attack by highly aggressive species resulting from irradiation of the carbon dioxide. The neutron damage leads, inter alia, to non-uniform dimensional changes and hence to internal stresses in the core bricks; the chemical attack reduces the amount of moderator and weakens the structure. Extensive in-pile and out-pile studies identified particular structural features of the graphite that can be quantitatively associated with its irradiation behavior. From this starting-point a specification was prepared for a graphite more suited to reactor applications than previously available materials, and development work, in the laboratory and in industry, has made considerable progress toward meeting this specification on the tonnage scale. (auth)

26096 THE INFLUENCE OF ENVIRONMENT ON THE DEVELOPMENT OF MATERIALS FOR NUCLEAR REACTORS. R. W. Nichols (United Kingdom Atomic Energy Authority, Culcheth, Lancs, Eng.). p.137-61 of "Advances in Materials. Inter-Disciplinary Symposium, Third and Fourth Sessions, 7 April, 1964." London, The Institution of Chemical Engineers, 1964.

The selection and development of materials is as much decided by the chemical and physical environment as it is by the need to carry out a particular engineering function. With regard to nuclear reactors, the important points have been that reactor components are bombarded by fast neutrons and that they are subjected to high temperatures in oxidizing coolants. The necessity to meet these requirements is discussed in terms of reactor structural and canning materials. For the reactor pressure vessel steels, the effect of irradiation gave emphasis to the development of notch ductile steels and weld metals, and later to the development of higher strength steels with good notch ductility. For gas-cooled reactors it was necessary to develop finned tubing which gave satisfactory performance in the heat exchangers. The particular corrosion requirements in these heat exchangers have directed attention to the use of high chromium ferritic steel. In pressure tube reactors the need for neutron economy, strength, and corrosion resistance led to the development of Zircaloy-2. More recent work has aimed at the development of zirconium–niobium alloys to give better strength, corrosion resistance and hydrogen pick-up. Other current work is aimed at the assessment of the important modes of failure, with special attention to the effects of irradiation and of hydrogen on properties. Turning to canning materials, the choice of Magnox for the current power reactors arose from consideration of oxidation resistance and ductility, whereas in the Dounreay Fast Reactor, compatibility requirements with the metallic uranium fuel led to the selection of niobium. More recently, the good high temperature strength and corrosion resistance of stainless steel and nickel alloys led to them being considered for a number of high temperature systems, e.g., in the fast reactor, gas-cooled reactors and high-temperature steam-cooled reactors. In the Advanced Gas-Cooled Reactor the primary problem was resistance to corrosion by the carbon dioxide coolant, and a 20% Cr–25% Ni steel was developed to meet this requirement with satisfactory structural stability, while some effects of irradiation on the properties of this material are reported. (auth)

26097 SOME FUNDAMENTAL ASPECTS OF NUCLEAR RADIATION EFFECTS IN SPACECRAFT THERMAL CONTROL MATERIALS. J. E. Gilligan and R. P. Caren (Lockheed Missiles and Space Co., Palo Alto, Calif.). 26p. (CONF-532-1)

From Symposium on Thermal Radiation of Solids, San Francisco, Mar. 1964.

The methods and results of an investigation to determine the mechanisms by which solar reflector thermal control systems degrade under separate and combined ultraviolet and nuclear radiations are described. Appropriate

optical and radiation effects theory is compared with the published results of irradiation experiments in which transparent analogs of certain dielectric and semiconductor pigments were studied. Conclusions on the equivalence of ultraviolet and nuclear radiation effects, basic causes of induced reflectance changes, and possible means of limiting the degradation due to these radiations are included. 55 references. (auth)

METEOROLOGY

26098 (NRL-6054) CHARACTERISTICS OF AIR FILTER MEDIA USED FOR MONITORING AIRBORNE RADIOACTIVITY. L. B. Lockhart, Jr., R. L. Patterson, Jr., and W L. Anderson (Naval Research Lab., Washington, D. C.). Mar. 20, 1964. Contract AT(49-7)-2435. 17p.

A comparison was made of the more important characteristics of the available filter materials, which are currently in use by various systems for monitoring airborne radioactivity throughout the world. Most of the materials described are commercially available. The filter characteristics measured are such physical properties as tensile strength, thickness, density, ash content, retentivity toward 0.3μ dioctyl phthalate (DOP) aerosol particles as a function of air velocity, retentivity toward airborne fission products and natural radioactive aerosols (radon daughters) at several air velocities, flow rate as a function of pressure drop across the filter, and the relative rates of clogging by atmospheric dust. The observation of a rapid change in flow with dust loading of some of the filter media suggested the systematic study of such changes as possibly a procedure for monitoring the dust content of the atmosphere. (auth)

26099 RADIOACTIVE DEBRIS FROM NUCLEAR EXPLOSIONS IN HIGH ALTITUDES. E. Keppler (Max-Planck-Institut fur Aeronomie, Lindau, Ger.), G. Pfotzer, and W. Riedler. J. Atmospheric Terrest. Phys., 26: 429-36(Apr. 1964).

During the last quarter of 1962, several balloons carrying radiation detectors were launched over Lindau/Harz (Germany), Kiruna (Sweden) and Tromsø (Norway). Excess radiation was measured during all flights, the cause of which is interpreted to be radioactive debris from nuclear weapons tests. An estimate on the activity gives a maximum value of about 10^{-12} Curie/cm^3, measured on 22 October over Lindau. Possible relations between the radiation measurements and v-l-f propagation are discussed. (auth)

26100 EFFECTS OF ARCTIC NUCLEAR EXPLOSIONS ON SATELLITE RADIO COMMUNICATION. P. R. Arendt and H. Soicher (Army Electronics Research and Development Lab., Fort Monmouth, N. J.). Proc. IEEE (Inst. Elec. Electron. Engrs.), 52: 672-6(June 1964).

Russian Arctic nuclear explosions during the fall and winter of 1961 produced anomalous blackout of radio signals from various satellites. The frequency range of observation was between 20 and 400 Mc. Besides the blackout, reception from far beyond the geometric horizon was observed. These anomalies of satellite reception are tentatively correlated to two shot-produced centers of disturbance. The anomalies repeated themselves at specific time intervals after the explosion. (auth)

26101 FAST NEUTRON FLUX IN THE ATMOSPHERE. Rosalind Bremmer Mendell. Thesis, New York, New York Univ., 1963. 150p.

A fast neutron detector, designed for rejection of other components of the primary and secondary cosmic radiation, was carried by balloon up to 90,000 feet on November 8, 1962, from Sioux Falls, South Dakota. The detector consisted of an inner liquid scintillator, employing pulse shape discrimination, and a thin 4π phosphor shield for rejection of charged particles. Both scintillators were viewed by a single photomultiplier. Thus, problems related to local production of neutrons in the material around an inner detector were minimized. In the November flight, the counting rates of two energy intervals of neutrons, between 1 and 10 Mev, were transmitted. The best fit to a power law spectrum, deduced from the relative counting rates in the two channels was $N(E)dE = 2.6E^{-(1.16 \pm 0.2)} \exp-(0.006X)dE$ neutrons/cm^2-sec Mev in the equilibrium region. The neutron flux, between 1 and 10 Mev, rose on ascent to a broad maximum at about 75 g/cm^2. The flux at the maximum was 1.9 neutrons/cm^2-sec. It dropped at altitude, 17.7 g/cm^2 to 1.4 neutrons cm^2-sec. The attenuation length for the neutron-producing radiation in the atmosphere was 145 ± 6 g/cm^2. Recent measurements by different investigators of the fast neutron flux above the equilibrium region of the atmosphere have differed from each other by a factor of 2-3. An attempt is made to resolve this difference. (Dissertation Abstr.)

26102 IONIZATION DUE TO THE VERY SOFT SEA LEVEL RADIATION. Joshua Siderowitz. Thesis, New York, New York Univ., 1962. 118p.

Measurements of the radiation intensity at sea level (over water) with a thin-wall ionization chamber show the existence of a very soft ionizing radiation, having an ionization density of $(16.2 \pm 2.4) \times 10^{-2}$ ion pairs cm^{-3} sec^{-1} (standard air). This soft radiation accounts for $4.5 \pm 0.5\%$ of the total ionization density, and can be almost completely absorbed by 400 mg/cm^2 filter. Freon-12 was used as the chamber gas to provide for preferential recombination of the ions in the alpha tracks arising from the natural radioactivity in the chamber wall. The chamber window is 4.54×10^3 cm^2 in area, and is made of an aluminized Mylar film, 1.77 mg/cm^2 thick, having a low energy cut off of approximately 35 kev for electrons. Measurements made with aluminum, iron, and plexiglas filters show no clear Z-dependence, indicating that the soft radiation was due primarily to an electron flux. From the decrease in ionization current with filter thickness it was computed that this flux consisted of approximately $(1.7 \pm 0.9) \times 10^{-3}$ electrons cm^{-2} sec^{-1} below 1.8 Mev. This soft radiation can be accounted for in terms of the soft beta radiation arising from the decay products of radon normally present in the atmosphere. It was computed that an activity of 10^{-13} curies/liter (typical of values reported for the New York City area) would make a contribution of 0.8×10^{-3} electrons cm^{-2} sec^{-1} to the flux below 2 Mev. This compares favorably with the flux of $(1.7 \pm 0.9) \times 10^{-3}$ electrons cm^{-2} sec^{-1} determined from the filter study. (Dissertation Abstr.)

PHYSICS

General

Refer also to abstract 26718.

26103 (AROD-3588:2) INVESTIGATIONS OF ION AND ELECTRON DRIFT VELOCITIES IN CESIUM. Final Report. L. M. Chanin (Honeywell Research Center, Hopkins, Minn.). Mar. 25, 1964. Contract DA-31-124-ARO(D)-11. 19p.

Measurements were made of the drift velocities of ions and electrons in cesium vapor. The main results of the ion measurements, which were previously described in detail in the Interim Technical Report "The Mobilities of Cesium Ions in Cesium" are given, and the electron drift velocity technique, the results, and conclusions reached regarding the electron drift velocity measurements are discussed. See also the interim technical report NSA 18: 2541. (auth)

26104 (BM-RI-6455) ABSORPTION CORRECTIONS FOR INTENSITY OF X RAYS SCATTERED BY WEAKLY ABSORBING POLYTYPE-CRYSTALLINE MATERIALS. Victor H. Tiensuu, Robert W. Smith, Jr., and Sabri Ergun (Bureau of Mines. Pittsburgh Coal Research Center). Nov. 1963. 12p.

Factual geometries are considered for x-ray scattering studies of weekly absorbing materials by both reflection and transmission methods. These studies are usually made on slab specimens to obtain adequate scattered intensities; however, the intensities are appreciably influenced by absorption of the x rays in passing through the specimens. Conventional equations derived to account for this absorption are based on idealized geometries, but for polycrystalline carbons the use of idealized geometries leads to several percent error in the corrections to be made. Use of factual geometries substantially reduces this error. (auth)

26105 (CEA-R-2421) MICROANALYSEUR A SONDE ELECTRONIQUE: ETUDE DE LA CORRECTION DE FLUORESCENCE DUE AU SPECTRE CONTINU. (Electron Probe Microanalyzer: Study of the Fluorescence Excited by Continuous Radiation). Jean Henoc, Francoise Maurice, Alexis Kirianenko (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). Apr. 1964. 64p.

To permit the estimation of the correction due to fluorescence excited by continuous radiation, the ratio of the fluorescent emission to the total characteristic radiation leaving the specimen was determined experimentally on a set of pure elements, and the intensity of fluorescence excited by continuous radiation was calculated by means of a formula already established. A few examples of fluorescence calculations are given to illustrate the use of the values obtained. (auth)

26106 (D1-82-0306) CARRIER LIFETIME IN InSb AT HIGH CARRIER DENSITIES. R. W. Cunningham (Boeing Scientific Research Labs., Seattle). Oct. 1963. 12p.

It has recently become possible to inject electrons and holes into InSb at high densities. Lifetimes much larger than the small density values were observed. In order to gain information about the dominant recombination mechanism at low temperatures, the photon radiative lifetime was computed as a function of temperature. The recombination rate estimated from optical properties, was found. For $T \simeq 77°K$, the combination of radiative and defect center recombination was estimated. For $n_0 + p_0 \simeq 10^{14}cm^{-3}$, the electron and hole lifetimes will be different when Δn, $\Delta p < 5 \times 10^{15}cm^{-3}$. When $n_0 + p_0 \geq 10^{14}cm^{-3}$ the lifetimes are nearly equal for Δn, $\Delta p > 10^{11}cm^{-3}$. (auth)

26107 (ERR-FW-210) STUDIES OF MAGNETIC SHIELDING AND SUPERCONDUCTIVITY. J. M. Norwood and F. L. Gibbons (General Dynamics/Fort Worth. Div. of General Dynamics Corp., Fort Worth, Tex.). Aug. 1, 1963. Contract AF33(657)-11214. 48p. (AD-423178; N64-12926)

Theoretical considerations of magnetic (active) shielding of space vehicles against charged-particle cosmic radiation indicate inadequate treatment in feasibility studies. Simplified expressions for the magnetic vector potential lead to predictions of possibly fictitious completely shielded regions. The mathematical model presented avoids this deficiency, and a method of determining the completely shielded regions is developed. Experimental investigations establish the capability of winding superconducting solenoids and making junctions between superconducting wire and current-carrying leads. Junctions made by spot welding superconducting Nb–Zr wire to copper electrodes, including foil, prove to be superior in reliability, simplicity, and high-current capacity. Critical currents in three superconducting solenoids, constructed to operate at 10, 15, and 55 kilogauss, were lower than those measured in short segments by amounts consistent with data in available literature. (auth)

26108 (IS-839) DETERMINATION OF THE CRYSTALLOGRAPHIC LATTICE TYPE AND CELL CONSTANTS FROM X-RAY POWDER PATTERN DATA; A COMPUTER PROGRAM. O. D. McMasters and W. L. Larsen (Ames Lab., Ames, Iowa). Mar. 1964. Contract W-7405-eng-82. 120p.

A modified version of Ito's method, which is used to obtain the Bravais lattice type and cell constants from x-ray diffraction data in the form of $Q(=1/d^2)$ values, was programmed for use on the IBM 7074 computer. Sets of triclinic cells are established on the basis of the reciprocal-space Q-value data. The ternary quadratic equations that represent these cells in direct-space are subjected to the Delaunay reduction process. The "correct" reduced cell is selected and verified. The lattice type and cell constants are determined and the Miller indices for the x-ray reflections are generated. Techniques for refining the constants are suggested. (auth)

26109 (LA-2687) A STUDY OF TEMPERATURE MEASUREMENT PRECISION IN DEBYE-SCHERRER SPECIMENS DURING HIGH TEMPERATURE X-RAY DIFFRACTION MEASUREMENT OF THERMAL EXPANSION. R. G. Merryman (Los Alamos Scientific Lab., N. Mex.). June 1962. Contract W-7405-eng-36. 106p.

An internal standard of Au was calibrated and can be used for the precise temperature measurement of Debye-Scherrer specimens in high-temperature x-ray diffraction measurements of thermal expansion. The calibration method consisted of measuring the lattice parameters of a selected Au wire specimen in which the Au specimen formed one leg of a Pt/Au thermocouple, calibrated by the the National Bureau of Standards, with both specimen and thermocouple junction in the x-ray beam. The internal

standard is used by mixing Au powder, selected to match the analysis of the Au wire, with the Debye-Scherrer specimen and translating the Au lattice parameters to temperature from tables of a versus t for Au. It is suggested that the method can be extended to other selected materials. The lattice parameter a for Au and MgO was measured with precisions of 13.5×10^{-5} and 15.5×10^{-5} Å, respectively; and the average coefficient of linear thermal expansion, $\bar{\alpha}$, for Au and MgO was determined with precisions of 0.08×10^{-6} and 0.07×10^{-6}/°C, respectively. A Pt/Pt-10% Rh thermocouple in contact with the Debye-Scherrer specimen, which was tried in the initial phase of the study, was found to give errors as high as 85°C in the measurement of sample temperature. 82 references. (auth)

26110 (LADC-6438) FORCE-ON-THE-WALL CALCULATIONS FOR ONE-DIMENSIONAL DENSE GASES WITH INTERMOLECULAR POTENTIALS (thesis). Thomas Daniel Butler (Los Alamos Scientific Lab., N. Mex.). 1964. Contract W-7405-eng-36. 81p.

Submitted to New Mexico. Univ., Albuquerque.

The theoretical study of dense gases with strong intermolecular forces is impeded by lack of sufficient experimental information with which to compare predictions of the properties. High-speed computers can supply this information by calculating the detailed dynamics of molecular assemblages, thereby taking the place of an actual physical experiment. This information supplied by the computers not only can test the validity of existing theories, but also it can indicate directions for possible improvement in the theoretical approximations. In order to show the adaptability of computers to this task, the thesis deals with the theoretical and computer-experimental study of the force exerted on an end wall. The gas particles were restricted to move in one space dimension and to have only nearest-neighbor interactions. The theoretical approach predicted a force on the wall by using an approximate solution to the time-independent Liouville equation. The experimental data were obtained from the computer, which was programmed to simulate in detail the dynamics of the particles. Finite-difference approximations were written for the Newtonian equations of motion and were solved algebraically by the computer. The thesis presents comparisons for one-dimensional gas systems under a variety of conditions: different interparticle forces, two types of wall boundaries, several average energies per particle, and various numbers of particles in the system. The interparticle force was either inversely proportional to the separation distance between particles and repulsive, or else of Lennard-Jones type, with both repulsive and attractive terms. Most comparisons were made with the simpler repulsive force function. The boundaries were either specular or fixed-particle. In the latter, a particle identical with all others in the system remains stationary and forms a wall. Theory agreed well with the computer experiments for the repulsive force function. For the Lennard-Jones type, agreement ranged from good to poor. A discussion is presented that shows the possibility of applying this technique to more physically realistic problems in two space dimensions. (auth)

26111 (NP-13990) SOLID STATE AND NUCLEAR RESULTS FROM MÖSSBAUER STUDIES WITH I^{129}. D. W. Hafemeister, G. DePasquali, and H. deWaard (Illinois. Univ., Urbana). [1963]. 54p.

The Mössbauer effect of the 26.8-kev transition in ^{129}I was studied in a number of iodine compounds. The following results were obtained: the isomeric shifts for the alkali iodides were found to be linearly dependent on the number of 5p holes in the iodine ion. From this dependency, a calibration of the isomeric shift scale in terms of the 5s-electron density was obtained. The s and p populations inferred from these data are in sharp disagreement with those predicted by the simple theory of electronegativity. An explanation for this discrepancy is given; from the calibration mentioned, a relative change of nuclear radius $\Delta R/R = (R_{26.8} - R_{gnd})/R_{gnd} = 3 \times 10^{-5}$ is computed; the isomeric shifts for some iodates indicate that their 5s-electron density is about 18% larger than that of the iodides. This increase is caused by the partial removal of 5p-electrons from iodine in the I-O bonds, which results in reduced screening of the 5s electrons. This shift for potassium periodate implies that the 5s-electron density is decreased by 33% compared to the iodate. This decrease is attributed mainly to the sp hybridization of the I-O bonds in KIO_4. The charge removed per I-O bond calculated from the isomeric shifts of the iodates and periodate is 0.61 e; the quadrupole splitting of KIO_3 was used to determine the ^{129}I quadrupole ratio, $Q_{26.8}/Q_{gnd} = 1.23 \pm 0.02$. The asymmetry of the iodate spectrum and the sign of the quadrupole moment show that the sign of the iodate field gradient is negative. The values of the quadrupole coupling constant, eqQ, at 80°K for KIO_3 and NH_4IO_3 are in agreement with NMR results and $eQ_{127} = 1030 \pm 20$ Mc/sec for $Ba(IO_3)_2$; and the recoilless fraction was found to deviate from 0.26 by less than 25% for all alkali iodides at 80°K. (auth)

26112 (NP-14017) CYCLOTRON RESONANCE LINE-BROADENING DUE TO IONIZED IMPURITY SCATTERING IN GERMANIUM. Technical Report, Ser. A, No. 106. Kenji Sekido, Masakazu Fukai, and Hajimu Kawamura (Tokyo Univ. Inst. for Solid State Physics). Apr. 1964. 30p.

Line broadening due to ionized impurity scattering was measured in 6-mm band cyclotron resonance experiments on germanium at 11°K. Use of a heavily compensated specimen together with an attenuated carrier-exciting illumination has made possible observation of the broadening effect. By analyzing the increment of half-width, the relaxation time for ionized impurity scattering was evaluated and is in approximate agreement with the value from the Conwell-Weisskopf formula. The result may be reasonably accepted, since, in the present experimental condition, the mean cyclotron radius is comparable with or larger than the magnitude of the force range of the scattering potential. (auth)

26113 (ORNL-3582) PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JANUARY 31, 1964. (Oak Ridge National Lab., Tenn.). June 1964. Contract W-7405-eng-26. 172p.

Thirty-seven papers are included; separate abstracts have been prepared for 33. Four papers were previously abstracted in NSA, as nos. 18: 4325, 18: 20729, 18: 20730, and 18: 24444. (T.F.H.)

For abstracts of individual papers see: 25749, 25977, 25978, 25979, 25980, 25981, 25982, 26114, 26277, 26278, 26387, 26534, 26535, 26536, 26537, 26538, 26539, 26540, 26541, 26542, 26543, 26544, 26545, 26546, 26547, 26548, 26549, 26550, 26551, 26552, 26553, 26554, and 26555.

26114 (ORNL-3582(p.36-7)) OPTICAL PHYSICS. P. M. Griffin, H. W. Morgan, O. B. Rudolph, P. A. Staats, K. L. Vander Sluis, T. A. Welton, and G. K. Werner (Oak Ridge National Lab., Tenn.).

An investigation of the gas laser led to improvements in the optical system, and in the control of gas excitation. A

number of infrared laser transitions have been observed in rare-gas discharges. (auth)

26115 (SCL-TM-64-53) STRESS ANALYSIS OF FILAMENT-WOUND SHELL STRUCTURES. L. A. Behrmann (Sandia Corp. Livermore Lab., Livermore, Calif.). May 1964. Contract AT(29-1)-789. 23p.

A computer program was written to facilitate the stress analysis of filament-wound structures. The analysis uses the theory of continuum mechanics rather than netting analysis. (auth)

26116 (WADD-TR-61-72(Vol.XIX)) RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. VOLUME XIX. THERMAL STRESSES IN ANISOTROPIC HOLLOW CYLINDERS. Tu-Lung Weng (National Carbon Co., Parma, Ohio). June 1963. Contract AF33(616)-6915. 45p. (AD-427734)

The equations of thermal stresses and displacements in anisotropic hollow cylinders subjected to various arbitrary temperature boundary conditions were derived. The hollow cylinder is assumed to be made of transversely isotropic material. Several numerical examples are treated and the effects of the degree of anisotropy on the magnitudes of the critical stress and maximum permissible gas temperature for various sizes of grade ATJ and grade ZTA graphite hollow cylinders are examined. The errors that could result from the assumption of isotropic material are calculated. (auth)

26117 (JPRS-23767(p.57-61)) EXPERIMENT ON THE AREA OF MOVEMENT OF CHARGED PARTICLE IN DIPOLE MAGNETIC FIELD. Chiu-chang Chao, Yung-lan Hsu, and Kuo-ch'eng Chou. Translated from K'o Hsueh T'ung Pao, No. 11, 56-7(1963).

Experiments using glow discharges in magnetic fields were conducted to study the area of movement of charged particles in the dipole magnetic field and the effects of disturbances. The results are discussed with reference to space physics. (D.L.C.)

26118 CRYSTALLOGRAPHIC DATA ON UO_2WO_4 AND UO_2MoO_4. E. F. Juenke and S. F. Bartram (General Electric Co., Cincinnati). Acta Cryst., 17: 618(May 10, 1964).

Double oxides of uranium with tungsten or molybdenum were prepared by co-calcining mixtures of their oxides in air at temperatures of 800 to 1000°C. Powder diffractometry and Weissenberg single-crystal photographs established the crystal symmetry as monoclinic. The space group was unambiguously determined from systematic absences to be $P2_1/c$ with 4 formula units in the unit cell. Calculated theoretical densities are 6.63 and 5.50 g cm^{-3} for UO_2WO_4 and UO_2MoO_4, respectively. Data are tabulated. (P.C.H.)

26119 LATTICE ENERGY TRANSFER AND STIMULATED EMISSION FROM $CeF_3:Nd^{3+}$. J. R. O'Connor (Massachusetts Inst. of Tech., Lexington) and W. A. Hargreaves. Appl. Phys. Letters, 4: 208-9(June 15, 1964).

The laser properties of CeF single crystals, particularly the transfer of lattice energy to stimulate emission from $CeF_3:Nd^{3+}$, were investigated. Under optical pumping of laser etalons, stimulated emission occurred at 1.0638 μ and was π polarized. The threshold for emission by $CeF_3:Nd^{3+}$ was found to be rather high. The reasons and probable solution for this situation are indicated. (D.C.W.)

26120 ANALYSIS OF THE RELIABILITY OF THE METHODS USED FOR THE STUDY OF CONTINUOUS SPECTRA OF FAST NEUTRONS AND γ-QUANTA. G. G. Doroshenko, V. I. Glagolev, I. R. Barabanov, and I. V. Filyushkin. At. Energ. (USSR), 16: 218-23(Mar. 1964). (In Russian)

Examination of the continuous fast-neutron and γ line spectra, which are different from the δ-functions, involved the solution of a linear equation system. An exact solution of these equations does not necessarily indicate that the results obtained are reliable. While studying continuous γ spectra, several authors noted that occasionally oscillations occur in the hard portion of the spectrum; these oscillations did not seem to be related to the spectra. In order to clarify this point, the reliability of several matrix models was investigated. The methods are characterized by their correlation with a straight matrix and by the accuracy of the field. This correlation, $\rho = \sqrt{\lambda_{max}/\lambda_{min}}$, where λ_{max} and λ_{min} indicate the maximum and the minimum eigenvalues of the symmetrical matrix AA, was used as the measure of the reliability of the system. The spectrometric matrix methods defining the shape of the lines and the differential and integral methods of the counting efficiency were compared and in every case the correlation with the shape of the lines, the rank of the matrix, and the energy range were examined. It was found that in the case of poorly shaped lines to counting efficiency method is to be preferred. (TTT)

26121 DISTRIBUTION OF PHOTONS AND IONS CREATED ALONG THE TRAJECTORY OF AN α PARTICLE IN XENON. Jean-Louis Teyssier, Daniel Blanc, and Jean Brunet (Nuclear Physics Center, Faculte des Sciences, Toulouse). Compt. Rend., 258: 3676-8(Apr. 6, 1964). (In French)

The distribution of photons created along the trajectory of an α particle in xenon under pressures from 415 to 715 torr was studied. The distribution has the form of a Bragg curve. The point where the density of creation of photons is maximum is placed nearer the end of the path than that corresponding to ions. The distance which separates the two maxima is inversely proportional to the pressure. (tr-auth)

26122 EVOLUTION OF THE TRANS-ALFVÉNIC NORMAL SHOCK IN A GAS OF FINITE ELECTRICAL CONDUCTIVITY. L. Todd (Cambridge Univ., Eng.). J. Fluid Mech., 18: 321-36(Mar. 1964).

The stability of a steady, plane, one-dimensional trans-Alfvénic shock to small transverse disturbances in the velocity and magnetic field is discussed. In the undisturbed flow the magnetic field and velocity are normal to the plane of the shock which is treated as a discontinuity in an inviscid gas of zero thermal conductivity. However, the electrical conductivity of the ambient gas is taken to be finite, i.e., the magnetic diffusivity is very much larger than both the viscous diffusivity and the thermal diffusivity. A small uniform transverse perturbation of the magnetic field is imposed at zero time. A specific super-Alvénic normal shock is chosen. Computed values of the magnetic field, in and near the shock, are given for various later times. Two diffusing Alfvén waves of the amplitudes predicted by infinite conductivity theory are shown to propagate away from the shock region, leaving behind the expected steady-state shock profile. Similar computations are carried out for a specific trans-Alfvénic normal shock. An analytic asymptotic solution, valid for large times, is also obtained. This result agrees with the computations carried out. The shock profile of the transverse quantities is one which grows linearly with time. Outside this magnetohydrodynamic shock region that surrounds the trans-Alfvénic hydrodynamic shock (discontinuity), steady states

are reached in each of which the transverse velocity and transverse magnetic field are uniform. An incident Alfvén wave, consisting of a weak diffusing current sheet, produces these same effects. The resolution of an arbitrary transverse fluctuation, in which both the magnetic field and the velocity have limiting values at large distances from the shock, is discussed. The solution for large times is found. It is shown that the trans-Alfvénic normal shock and its two limiting cases, the null switch-on and null switch-off shocks, are unstable to general transverse disturbances although there exist particular disturbances of this kind which will not destroy them. An integral condition is obtained which, together with the relevant boundary conditions, determines the profiles of the transverse quantities in the trans-Alfvénic normal shock whenever a steady state is reached. This removes the puzzling arbitrariness of these profiles. (auth)

26123 THE REFLEXION AND DIFFRACTION OF SHOCK WAVES. D. C. Pack (Royal Coll. of Science and Tech., Glasgow). J. Fluid Mech., 18: 549-76(Apr. 1964).

The normal and oblique reflection of shock waves from a rigid wall and the diffraction of shock waves in gases are discussed. (C.E.S.)

26124 MAGNETOHYDRODYNAMIC FREE CONVECTION. N. Riley (Durham Univ., Eng.). J. Fluid Mech., 18: 577-86(Apr. 1964).

The flow of an electrically conducting fluid up a hot vertical plate in the presence of a strong magnetic field normal to the plate is considered. A solution is developed based on the idea of matching outer and inner solutions in the moving layer of fluid. An approximate Pohlhausen method of solution is also given which yields results in fairly good agreement with the exact analysis. (auth)

26125 THE INTERACTION OF TRANSVERSE ELECTROMAGNETIC PLANE WAVES AND A MOVING IONIZING SHOCK WAVE IN THE PRESENCE OF A MAGNETIC FIELD. W. F. Hughes and F. J. Young (Carnegie Inst. of Tech., Pittsburgh). J. Fluid Mech., 19: 11-20(May 1964).

Propagation of a transverse electromagnetic wave along a d-c magnetic field and interaction with a moving shock wave is investigated. The direction of propagation is normal to the shock front. Solutions to electromagnetic fields, gas velocities, and Doppler shifts in frequency are found in both the ionized and un-ionized gases. A frequency is obtained at which electromagnetic reflection from the shock front is minimized. In the ionized gas behind the shock front a fast and a slow electromagnetic wave result. By adjusting the shock velocity the frequency of the slow wave can be either raised or lowered. This frequency change, however, is not the Doppler shift and, consequently, can be made much larger than the Doppler shifts encountered at nonrelativistic velocities. The slow wave attenuates much less than the ordinary fast wave, and applications to diagnostics and communications through plasmas and laser-beam frequency multiplication may be possible. (auth)

26126 ON MAGNETOHYDRODYNAMIC FLOWS WITH ALIGNED MAGNETIC FIELDS. M. B. Glauert (Univ. of Manchester, Eng.). J. Fluid Mech., 19: 49-59(May 1964).

The boundary layers due to finite viscosity and magnetic diffusivity are studied in relation to two models of the flow of a conducting fluid past a body in an aligned magnetic field. In each case it is deduced that the growth of the boundary layer may have substantial effects, such as to raise doubts about the validity of the assumed basic flow patterns. (auth)

26127 RADIOACTIVITY IN SPUTNIK 4 FRAGMENT. John T. Wasson (Air Force Cambridge Research Labs., Bedford, Mass.). J. Geophys. Res., 69: 2223-30(June 1, 1964).

The activities of ^{48}V, ^{54}Mn, and ^{60}Co in the fragment that fell in Manitowac, Wisconsin, were determined to be (at the time of fall) 37 ± 10, 227 ± 29, and 145 ± 30 dpm/kg. These results are compared with other determinations and with observations on meteorites. Some possible explanations (none completely satisfactory) for the observed radioactivity in the fragment are discussed. (D.C.W.)

26128 THE MOVEMENT OF CHARGED PARTICLES IN THE FIELD OF A MAGNETIC DIPOLE, CONSIDERING ENERGY DISSIPATION. V. M. Vakhnin, G. A. Skuridin, and I. N. Shvachunov. Kosmich. Issled., 1: 414-35(1963).

The movement of charged particles in a magnetic field was analyzed by the phase plane method both in a conservative approximation and with consideration of losses of their kinetic energy due to radiation, thus providing a qualitative picture of the influence of kinetic energy losses on the particle trajectory. These losses were considered in the form of small dissipation perturbations of the conservative approximation. The existence of certain critical trajectories, at which particle seizure by the magnetic field occurs at arbitrarily small energy losses, was demonstrated. It is obvious that at small, but finite, energy losses, seizure may also occur in the case of other trajectories, close to critical. The phase plane method was found to be particularly convenient when studying the movement of the particle in a complex field, containing a dipolar and homogeneous (external) component. Conservative approximations and their dissipation perturbations were considered for three idealized situations: magnetic dipole with no external magnetic field present; magnetic dipole in space with uniform magnetic field parallel to the magnetization vector of the dipole's magnetic field and located in its equatorial plane; and magnetic dipole in space with uniform magnetic field antiparallel to the magnetization vector of the dipole's magnetic field and located in its equatorial plane. The analysis was conducted in the magnetic plane of the dipole. In the first case (movement of a charged particle in the field of a magnetic dipole in the absence of an external magnetic field), the differential equation for the phase trajectory of the motion of the charged particle is discussed. Following this, isoclines and a field of directions were constructed in the phase plane in a conservative approximation. Phase trajectory behavior was considered at large and small values of u and w, as well as the trajectories of charged particles in a magnetic field that correspond to the phase trajectories, both with and without consideration of energy dissipation. With few exceptions, this treatment was also followed in the case of the other two ideal hypotheses. (A.I.D. Press, Vol. 2, No. 224, May 1964)

26129 ON THE USE OF GAUZES IN ELECTRON OPTICS. J. L. Verster (Univ. of Delft). Philips Res. Rept., 18: 465-605(Dec. 1963).

Electron optics can be treated in the same way as light optics, at least theoretically, once the electron-optical index of refraction is introduced. This follows from the facts that rays of light satisfy Fermat's principle, in which the index of refraction appears, and that the trajectories of electrons satisfy Maupertuis' principle of least action, both principles being variational equations with the same conditions. If the electron-optical index of refraction is defined, an important chapter of light optics, such as the theory of geometrical optics, can be applied to electron

optics. It might appear that electron optics is only a special kind of light optics and therefore cannot lead a life of its own. That this is not true will become clear if electron optics is considered closer. An electron-optical lens consists of an electromagnetic field, whose electrostatic part is brought about by electrodes and whose magnetic part is brought about by pole pieces, by coils or by both. If it is required that the region where the electrons move is free from electrodes and pole pieces, then the field in this region can only be controlled by electrodes, etc., at the boundary. Therefore the most obvious difference with light-optical lenses is that, in order to know either the field or the electron optical index of refraction, a boundary value problem must be solved. Since the electrons move in a field, their trajectories will in general be curved. In order to obtain the trajectories, certain differential equations, whose coefficients depend on the field, must be integrated. Consequently, with regard to the calculation of the rays, electron optics is completely different from light optics. A third important difference between electron-optical and light-optical lenses consists of the fact that it is very difficult to correct the former for third-order spherical aberration, whereas designing light-optical lenses that are free from this aberration presents no problem. In order to solve the first of the problems mentioned above, electron opticists built electrolytic tanks and resistor network analogs, both devices being capable of solving Laplace's equation with boundary conditions. An electrolytic tank is described. The manner by which the second problem is solved depends to a large extent upon the kind of rays that are required. If, in order to determine the paraxial or Gaussian properties of the lens, paraxial rays must be calculated, it suffices to determine the axial potential distribution from which the rays can be calculated rather easily, using the so-called paraxial ray equation. The calculation of rays that are no more paraxial is, however, very laborious, if they are to be calculated from the field. In order to obtain such rays analog computers were built that trace the trajectory described by the electron. Computers of this kind are connected with an electrolytic tank from which they derive the data necessary for tracing the ray. A detailed description of such an analog computer will be given. With regard to the third difference between electron-optical and light-optical lenses, it is well known that the quality of the former can be improved by the use of a foil. A comparison is made of three kinds of lenses two of which have one foil. It will be shown that the one-foil lenses have better optical qualities. If, however, the scattering by a gauze-shaped foil is taken into account, it appears that the kind of application determines which lens is to be preferred. The properties of a special kind of television pick-up tube is dealt with. Since it was necessary, for the determination of its properties, to know the trajectories of electrons that were so far off-axis that they were just reflected or just transmitted by a grid-shaped structure, the rays were traced by the ray tracer. (auth)

26130 QUANTUM RELAXATION, THE SHAPE OF LATTICE ABSORPTION AND INELASTIC NEUTRON SCATTERING LINES. Melvin Lax (Bell Telephone Labs., Murray Hill, N. J.). Phys. Chem. Solids, 25: 487-503 (May 1964).

The fundamental optical lattice vibrations are treated as the system, the remaining lattice vibrations as the reservoir, and the anharmonic interactions as the coupling in a general density matrix theory of relaxation processes. An immediate result of this theory are expressions for frequency dependent level shifts and damping coefficients as well as corresponding frequency-dependent coupling coefficients between the optical modes. If the coupling coefficients are neglected, and if in the expressions for the shift and damping coefficients anharmonic interactions in the reservoir are neglected, the expressions simplify to those obtained by Wallis and Maradudin by summing an infinite ladder of diagrams. By treating an arbitrary mode as the system and using the fluctuation-dissipation theorem, the relation between the lifetime and shift of the mode and its contribution to the one-phonon inelastic neutron scattering line shape is derived. The relaxation theory used is based on a systematic improvement of the Hartree approximation in which the system and reservoir are treated in a symmetric fashion. (auth)

26131 MEASUREMENT OF MAGNETICALLY INDUCED SOUND ABSORPTION IN LIQUID SODIUM AND POTASSIUM. S. V. Letcher and R. T. Beyer (Brown Univ., Providence). Phys. Fluids, 7: 375-8(Mar. 1964).

The attenuation of ultrasonic waves in liquid sodium and potassium due to an external, d-c magnetic field was measured between 2.25 and 40 Mc. The experimental results agreed with the theoretical expression within experimental error, indicating a coupling of acoustic and hydromagnetic modes at low frequencies. (auth)

26132 APPROXIMATIONS TO THE PAIR CORRELATION FUNCTION FOR A HARD-SPHERE FLUID. Max Klein (National Bureau of Standards, Washington, D. C.). Phys. Fluids, 7: 391-401(Mar. 1964).

The equation of state for hard spheres as predicted by the chain, watermelon, convolution-hypernetted chain (CHNC), Percus–Yevick, and two new approximations to the pair correlation function are compared with each other and with a reference isotherm. The equations of state of the chain and watermelon approximations were found to be only slight improvements over the linear correction to the ideal gas law. The Percus–Yevick theory was found to be an improvement over the CHNC approximation for hard spheres in agreement with the results of Hoover and Poirier for hard cubes and of Broyles for several densities of the Lennard–Jones gas. The new approximations are designated n = 1 and n = 2. They make use of the solutions to the CHNC integral equation but do not include all the diagrams for the pressure. The approximation n = 2 was found to yield an equation of state in excellent quantitative agreement with the reference isotherm for densities up to 0.707 times the close packed density. Both the nearest and next nearest neighbors were computed as a function of density in each approximation. Only the CHNC and Percus–Yevick results extrapolate to the proper value at the density of close packing. Both of these approximations, furthermore, indicate the existence of a singularity at densities less than or equal to that of close packing. The approximations considered seem to form part of a uniform approach to the reference isotherm. At the same time, the representations of the known virial coefficients associated with each do not approach the correct virial coefficients in a uniform fashion. Therefore, an understanding of this sequence of approximations cannot be had from the usual examination of virial coefficients. (auth)

26133 PERTURBATION CALCULATION OF MIXED PAIR CORRELATION FUNCTIONS. B. A. Lowry, H. T. Davis, and S. A. Rice (Univ. of Chicago). Phys. Fluids, 7: 402-6(Mar. 1964).

A perturbation calculation of the change in pair correlation function (relative to some reference system) is presented for the case when the intermolecular pair potential is altered (relative to the same reference system). The

analysis is developed in detail for the case of a very dilute solution of perturbing molecules in a host dense fluid, but the case of the pure fluid is also examined. Numerical calculations for a variety of inverse power potentials show that when the perturbation potential is much smaller than kT, many body interaction terms are very small and the simplest approximation, $g_2(R) = g_2^0(R) \exp[-\beta V_p(R)]$ is valid. When $V_p \sim kT$, this is no longer true; the many body effects then make an important contribution to the change in $g_2(R)$. Explicit formulas are presented for the correction terms to order β^2 and general formulas valid for all β are displayed in unexpanded form. (auth)

26134 ISOBARIC PARTITION FUNCTION OF A GENERALIZED TONKS' GAS. Robert S. Northcote and Renfrey B. Potts (Univ. of Adelaide). Phys. Fluids, 7: 475-6(Mar. 1964).

It is shown that the derivation of the equation of state of a generalized Tonks' gas is simplified by the use of the isobaric grand partition function. The derivation of the isobaric partition function is outlined. (C.E.S.)

26135 SMALL PERIODIC DISTURBANCES IN POLYATOMIC GASES. L. Monchick (Johns Hopkins Univ., Silver Spring, Md.). Phys. Fluids, 7: 882-96(June 1964).

The Chapman–Enskog approximation to the velocity-energy distribution for a polyatomic gas is reinvestigated and found to yield unacceptable results for small amplitude sound waves. The solution to the linearized Boltzmann equation is then expanded in a set of orthogonal polynomials in the dynamic variables for translational and internal degrees of freedom, and an interative method of approximation is set up. This method of attack is a natural continuation of the work of Maxwell, Waldmann, of Ikenberry and Truesdell. Under some conditions the first iteration approaches the second Chapman–Enskog approximation (or Navier–Stokes approximation) as $t \to \infty$. The polynomial expansion was then truncated and the first iteration was used to calculate the heat flux, pressure tensor, and characteristic temperatures for a small amplitude sound wave. The second iteration was also investigated and was found to affect mainly only the heat fluxes. A useful formula is presented for the thermal conductivity of a polyatomic gas with N internal degrees of freedom in the limit of zero frequency. (auth)

26136 CALCULATION OF GAS TRANSPORT PROPERTIES AND THE INTERACTION OF ARGON ATOMS. J. A. Barker, W. Fock, and F. Smith (Commonwealth Scientific and Industrial Research Organization, Melbourne). Phys. Fluids, 7: 897-903(June 1964).

A method for calculating the collision integrals required for evaluating gas transport properties is described. The method is suitable for use with high-speed computers. Results are given for the Kihara spherical core potential function and for a potential function which Guggenheim and McGlashan derived for argon. The applicability of these potential functions to argon is tested by comparison with experimental viscosity and second virial coefficient data. (auth)

26137 REACTIVE GAS MACH STEMS. Roger A. Strehlow (Univ. of Illinois, Urbana). Phys. Fluids, 7: 908-10(June 1964). (LADC-6210)

A Fortran program was used to calculate the slip stream balance criteria for Mach stems produced in exothermic reactive gas mixtures. (C.E.S.)

26138 EXISTENCE OF KINETIC THEORY SOLUTIONS TO THE SHOCK STRUCTURE PROBLEM. Lowell H. Holway, Jr. (Raytheon Co., Waltham, Mass.). Phys. Fluids, 7: 911-13(June 1964).

For several of the methods used to calculate shock wave structure from the Boltzmann equation, solutions exist only for Mach numbers less than certain critical values. A fundamental mathematical reason why such solutions do not exist is outlined. (C.E.S.)

26139 MEASUREMENT OF THE VELOCITY OF SECONDARY FLOW IN TAYLOR'S STABILITY PROBLEM. R. B. Lambert, S. K. F. Karlsson, and H. A. Snyder (Brown Univ., Providence). Phys. Letters, 9: 229-30(Apr. 15, 1964).

A new method of studying hydrodynamic flows was developed. As an application, the steady-state circulation in Taylor vortices as a function of the Taylor number was measured directly. The critical Taylor number and the rate of growth of the vortices when the Taylor number is suddenly increased above the critical number were also observed. (M.J.T.)

26140 OPTIMUM CONTROL OF THE CONDUCTIVITY OF A FLUID MOVING ALONG A CHANNEL IN A MAGNETIC FIELD. K. A. Lur'e. Prikl. Mat. i Mekhan., 28: 258-67(1964). (In Russian)

Currents and electric fields were calculated for optimum fluid conductivity, velocity distribution, and external magnetic field. The problem consists of step functions in two independent variables $\sigma(x,y)$ (conductivity of the fluid) satisfying the inequality $\sigma_{min} \leq \sigma(x,y) \leq \sigma_{max}$ and optimum control of $\sigma(x,y)$, which depends on the current and electric field distribution. The distributions of the current j and electric field potential z^1 in a conducting fluid moving at $V(v(x,y),0,0)$ in a magnetic field $B(0,0,-B(x))$, are described by: div. $j = 0$, $j = \sigma(-\text{grad } z^1 + 1/c\,[v,B])$, where σ is the electric conductivity of the fluid and v(y) and B(x) are assigned functions. (R.V.J.)

26141 THE THEORY OF DIFFRACTION OF CYLINDRICAL ELASTIC AND WEAK SHOCK WAVES. I. G. Filippov. Prikl. Mat. i Mekhan., 28: 296-304(1964). (In Russian)

The results of previously resolved non-stationary problems for plane weak shock wave diffraction near arbitrary shaped contours are reduced to the two-dimensional non-stationary problem of cylindrical weak shock and elastic wave diffraction. General theorems are developed for diffraction problems under general conditions. The problem of diffraction is resolved by a single method of quadratics, considering second approximations. (tr-auth)

26142 TOYA'S ELECTRON-PHONON INTERACTION AND LATTICE VIBRATIONS OF POTASSIUM. R. S. Srivastava and B. Dayal (Banaras Hindu Univ., Varanasi, India). Progr. Theoret. Phys. (Kyoto), 31: 167-76(Feb. 1964).

The specific heat and elastic constants of potassium were calculated using Toya's expression. In order to improve the agreement, the argument of Bardeen's g function was multiplied by a constant multiplier 1.07. While there is considerable discrepancy between the theoretical and experimental values, using the original expressions, the modified expressions yield much better agreement with elastic as well as thermal data. (auth)

26143 A NOTE ON THE THERMODYNAMIC POTENTIAL OF AN INTERACTING ELECTRON-PHONON SYSTEM. Mitsuo Watabe (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 31: 326-8(Feb. 1964).

An expression for the thermodynamic potential of a coupled electron-phonon is presented. Its proof is outlined, and a similar expression is written for a many-fermion system. The formula derived by Luttinger and

Ward for a many-fermion system with two-body interaction served as the basis for these expressions. (D.C.W.)

26144 STUDIES ON X-AGENT. XXII. INTERFERENCE OF THERMAL RADIATION WITH X-AGENT. Hideo Moriyama (Shonan Hygiene Inst., Kamakura, Japan). Yokohama Med. Bull., 13: 287-305(Aug. 1962).

X-agent is said to be a series of electromagnetic radiations that are temporarily changed in character whereby they acquire an ability to induce an unstable, or excited state into a substance through which they are passing. Radiations that can be changed into X-agent are said to be high-energy γ rays which can easily pass a 10-cm Pb shield. Sometimes, visible or thermal radiations are also to be changed into the agent. In such case, the X-agent fails to penetrate a thin metal plate or even black paper. Extremely low-energy X-agent may cause striped pattern formation in kaolin suspensions, indicating that the pattern formation is interfered with by thermal radiations. Thermal radiations appear to enhance the ability of X-agent to form the striped pattern. The involvement of the thermal radiations in the action of the agent was demonstrated also on red blood cells. The directional pattern of degree of hemolysis around a water bottle or around tin metal was sometimes different when the water or the tin was heated. This is said to result from the interference of the thermal radiation emitted from the heated substances with the X-agent which was acting upon the blood cells, not from the direct action of the thermal radiation upon the blood cells. The striped pattern formation in kaolin suspension could be enhanced when thermal radiation was passed into the suspension which was covered with a thin metal plate or with bricks through which the thermal radiation could not pass. (BBB)

26145 STUDIES ON X-AGENT. XXIII. MIRROR-IMAGING EFFECTS OF X-AGENT. Hideo Moriyama (Shonan Hygiene Inst., Kamakura, Japan). Yokohama Med. Bull., 13: 307-18(Aug. 1962).

X-agent is considered to be a spectrum of photons or electromagnetic radiations which are altered temporarily in their character. Most of the components of the agent may be high-energy γ rays produced by cosmic rays. However, some are of energies so low that they may be interfered with by thermal radiations. The production of X-agent is believed to take place on the earth's surface, and its production is associated with the helicoidal motion of the earth. It is proposed that when the earth is in a special orientation in the galaxy in reference to neighboring stars, the situation may be most favorable for the production of the X-agent, and such may occur yearly in early summer. X-agent is said to have the ability to induce an unstable, or excited, state into a substance through which it is passing, and that this substance then has the ability to change photons or electromagnetic waves, which may pass afterward through the substance, into X-agent. In other words, photons or electromagnetic waves are changed into secondary X-agents if they pass through a substance which has previously been affected by the primary X-agent. In this way, electromagnetic radiations of various wave-lengths can be changed into X-agent. A so-called mirro-imaging effect of the X-agent is described whereby the agent affected, in an alternating pattern, is in a row of test tubes containing a substance, such as protein, red cells, kaolin. Such a pattern was regarded as the result of an interference between the primary and the secondary agent, the latter being produced by the contents of the test tubes. It is suggested that the striped pattern which has been observed in kaolin suspension may be produced in the same manner; also the production of layers of clouds in the upper sky is attributed to the same effect. (BBB)

26146 STUDIES ON X-AGENT. XXV. ACTIVATION OF WATER BY X-AGENT. Hideo Moriyama (Shonan Hygiene Inst., Kamakura, Japan). Yokohama Med. Bull., 13: 363-9(Oct. 1962).

These studies are based on the assumption that X-agent can convert a substance, by passing through it, to an unstable or activated state. Owing to this activated state, the substance may become capable of converting photons or electromagnetic radiations, which pass through it, into secondary X-agent. This activated state is only temporary, but the state, if produced in water, is said to be maintained for a relatively long time. Therefore, the water which is activated by X-agent continues to produce secondary X-agent for a period of time. Consequently, water can affect various substances placed around it, giving a pattern attributable to secondary X-agent. These experiments involved a frosted glass surface of a small glass vessel (absorption cell for the Leitz photometer) placed near a bottle of water, which had been activated by X-agent. The secondary agent produced by the water was recorded by the sensitive cell of the photometer. Thus a glass bottle containing one liter of water was activated in an incubator, and immediately after it was removed from the incubator, four absorption cells filled with water were placed close to the bottle; two of the cells were placed side by side on the north side and the other two on the south side. The transmittance of the absorption cells was measured by the photometer 30 min after being left in this state. As a control, a similar bottle of water which had not been placed in the incubator was used. The results show that a marked transmittance change was observed in the absorption cells placed near the water bottle which had been in the incubator, while no change was seen in cells placed near the water which had not been in the incubator. This demonstration of the effect of activated water was not always accomplished. X-agent was abundant on August 24 and 25, (probably 1961 (abst.)) and the demonstration was possible on August 26, but failed on the following days (27, 28, and 29). (BBB)

26147 INVARIANT-GROUP EQUATIONS FOR NONSTATIONARY CHARGED PARTICLE BEAMS. V. A. Syrovoi. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 1, 3-25 (Jan.-Feb. 1964). (In Russian)

Invariant group equations were developed for nonrelativistic monoenergetic nonstationary charged particle beams in arbitrary magnetic fields (H). It was assumed that at each point the velocity vector is a unique function. A series of analytical solutions describing certain processes in devices with plane, spherical, and cylindrical geometry are given. Basic equations were also obtained for a relativistic beam without consideration for the emissions from moving charges. (R.V.J.)

26148 ON ION BEAM NEUTRALIZATION. V. A. Levin. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 1, 26-30 (Jan.-Feb. 1964). (In Russian)

Neutralization of a one-dimensional ion beam during longitudinal electron injection was studied considering electron-ion friction and emission under stationary and nonstationary conditions. It is shown that friction automatically equalizes electron and ion flow. It is also shown that the extracted electron current is equal to the ion current even in cases in which dissipative forces are absent. (tr-auth)

26149 EFFECTS OF ELECTRON INERTIA ON SHOCK WAVE WIDTH IN MAGNETOHYDRODYNAMICS. Z. M.

Ioffe (Inst. of Astrophysics, Academy of Sciences, USSR). Zh. Tekhn. Fiz., 34: 426-8(Mar. 1964). (In Russian)

Conductivity anisotropy strongly effects the widths of inclined shock fronts but does not influence electron inertia when $a = (c/\omega_p)$ is smaller than the characteristic magnitude. When a is larger than the characteristic magnitude, electron inertia exerts a strong effect on wave front width. (tr-auth)

26150 RADIATION FROM A POINT CHARGED PARTICLE IN FLIGHT ALONG THE AXIS IN A SEMIINFINITE ROUND WAVE GUIDE. B. M. Bolotovskii and G. V. Voskresenskii. Zh. Tekhn. Fiz., 34: 711-17(Apr. 1964). (In Russian)

A Weiner-Hopf equation was used for developing expressions for point radiation of a charged particle traveling in or out along the axis of a round waveguide. Equations were obtained for radiation losses outside the waveguide and on excitations of intrinsic waves in a waveguide. (tr-auth)

26151 ON A STUDY OF A HIGH-RATIO MIRROR COIL. Walter John Fahey. Thesis, Cleveland, Case Inst. of Tech., 1963. 126p.

The use of a shaped single-turn coil to establish an electromagnetic field of requisite symmetry to produce an imploding spherical shock wave is studied. A preliminary analysis indicates spherical shape as suitable for the coil. A variety of means of theoretical investigation are proposed and discussed. Maxwell's equations are expanded in a quasi-static form and employed for analytical investigation of the spherical coil. The experimental program consists essentially of mapping the magnetic field produced. Comparison of analytical and experimental results indicates the necessary spatial configuration of electromagnetic field may be predictably achieved for a portion of the interior volume of the coil. A procedure for analysis and design based on a lumped parameter model of the coil is developed. Conclusions and recommendations for future work are presented. (Dissertation Abstr.)

26152 THE MECHANICS OF TURBULENCE. [A CONFERENCE], MARSEILLE, AUGUST 28th TO SEPTEMBER 2nd, 1961. New York, Gordon and Breach Science Publishers, 1964. 460p.

Twenty-four papers are included on theories of turbulence and associated experimental results. Diffusion and Lagrangian effects, energy transfer in homogeneous turbulence, steady fully developed turbulence, free turbulence, turbulent boundary layers, turbulence in compressible and electrically conductive media, and some recent developments are considered. (D.C.W.)

26153 ORTHO-PARA TRANSITION IN MOLECULAR HYDROGEN. John Carl Raich. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 69p.

An estimate of the probability of spontaneous transitions between rotational levels $J \rightarrow J-1$ in the ground electronic and vibrational states of the hydrogen molecule has been made. The probability per unit time was found to be about $[J^4/(2I+1)(2J+1)]$ $[1/5(10)^{11}$ year], where I is the initial nuclear spin. (Dissertation Abstr.)

26154 ELECTRON-NUCLEAR DOUBLE RESONANCE IN HOMOGENEOUSLY BROADENED SYSTEMS: METAL AMMONIA SOLUTIONS. Alf Lowell Cederquist. Thesis, St. Louis, Washington Univ., 1963. 96p.

A brief discussion of some ideas related to electron-nuclear double resonance (ENDOR) serves as an introduction to the concept of homogeneous ENDOR. A detailed theory is formulated around the framework of Bloch's development of relaxation theory. The theory is worked out for two magnetic particles having spin $\frac{1}{2}$ with the interaction between them and with the lattice unspecified. The case of a resalted ESR doublet is given in detail but no experimental verification to support the solution is given. The case of the unresolved ESR line is also developed and after extending the theory to include many identical nuclei (having any spin) interacting with the electron, it is verified by measurements taken on the metal-ammonia complex. The spin-lattice relaxation mechanisms in sodium-ammonia solutions at room temperature are investigated by the ENDOR method and the complex is discussed briefly from the standpoint of the ENDOR data. (Dissertation Abstr.)

26155 THEORETICAL STUDIES ON THE POTENTIAL CURVE OF THE METASTABLE HELIUM MOLECULE. Ronald Dean Poshusta. Thesis, Austin, Tex., Univ. of Texas, 1963. 47p.

The electronic energy of the $^3\Sigma_u^+$ state of He_2 was found by the variation method for sixteen internuclear separations. The calculations were performed using the CDC 1604 computer. A twelve term closed-shell wave function and a nine term open-shell wave function were developed and used separately to find the electronic energy. The potential curves from both calculations show a maximum at an internuclear separation of about 4.5 Bohr radii. The closed-shell result at the equilibrium separation establishes a new rigorous lower bound to the dissociation energy of 0.94 electron volts. The best previous calculation gave for this lower bound a value of only 0.11 electron volts. The presence of the maximum in both calculated potential curves confirms the results of previous investigators. Their conclusion that the actual experimental curve will show such a maximum is agreed with. A more refined wave function will be required to reach the best experimental estimate of 1.7 electron volts for the dissociation energy. (Dissertation Abstr.)

26156 SECONDARY ELECTRON EMISSION FROM SPECIALLY PREPARED SURFACES. Julius Brown. Thesis, St. Louis, Washington Univ., 1963. 95p.

An experimental tube was designed and constructed to investigate the secondary electron emission and possible field emission from specially prepared targets. The tube consisted of an electron gun section, a target that could be chilled to 77°K, and a collector to measure the secondary electron emission. The electrode voltages provided primary electron energies from 0 to 400 electron volts and permitted continuous variation of the primary energy and of the collector voltage with respect to the target. A base composed of a thick layer of evaporated aluminum provided the surface on which the special targets were deposited. The tube design permitted lowering the temperature of this base down to 77°K by introduction of liquid nitrogen into a well and return to room temperature by boiling off of the liquid nitrogen. With the gun turned on, the currents at the target and the collector were measured for wide ranges of primary electron energy and collector voltage. Xenon was admitted to the tube at pressures of 1.5×10^{-2} mm, 0.12 mm, and 1 mm at room temperature and frozen on to the base surface by the introduction of the liquid nitrogen. At each pressure level the secondary electron emission was measured for various combinations of primary energies and electrode voltages. The same thing was done with CO_2 at pressures of 1.4×10^{-2} mm, 8.5×10^{-2} mm, 1.25 mm, and 12.5 mm, and secondary electron emission was again measured. Reproducible results were obtained which indicated the existence of surface charging of the thin film targets. A potential difference was established across the film which was a function of the col-

lector voltage and resulted in a leakage current through the film. The potential difference also cut down the secondary emission by setting up retarding potentials, thus reducing the apparent yield σ to a value only slightly larger than 1. In terms of the experimental readings it was possible to estimate the magnitude of the surface potentials produced. Xenon was found to be a better emitting material than CO_2 by an order of magnitude, under the conditions of the experiment. Attempts to cause spontaneous emission by means of locally high electric fields as was done by L. Malter and others failed to yield such a response, indicating that xenon and CO_2 in the solid state do not maintain ionization for a sufficient length of time to provide the required field intensity. (Dissertation Abstr.)

26157 TEMPERATURE MEASUREMENTS IN HOT GASES BY THERMAL NEUTRON SCATTERING. Patrick David Doherty. Thesis, St. Louis, St. Louis Univ., 1962. 154p.

A general theory of the interaction of neutrons with gas molecules has been worked out by Zemach and Glauber (1956). In the case of a monatomic Maxwell-Boltzmann gas at temperature T, Robert M. Delaney has shown that the differential scattering cross section of a neutron gaining energy between ϵ and $\epsilon + d\epsilon$, $\epsilon = E - E_0$, and scattered at a polar angle θ into solid angle $d\Omega = 2\pi \sin\theta d\theta$ is given by

$$\sigma'(\theta,\epsilon,m,T)d\epsilon = C\sqrt{\frac{EE_0}{T(m_0q^2)/m}} \times \exp\left(\frac{-[E-E_0+(m_0q^2)/m]^2}{4kT(m_0q^2)/m}\right) d\epsilon$$

where, $q^2 = E + E_0 - 2\cos\theta\sqrt{EE_0}$, $C \propto (\sigma_{free})/\mu^2$ and μ is the reduced mass of the molecule and neutron, m is the mass of the gas molecule, and m_0 the neutron mass. A measurement of the energy gain of the neutrons scattered at a definite angle permits the calculation of the temperature of the scattering gas. This measurement was made by a transmission experiment, using a neutron beam from the thermal column of the Argonne National Laboratory CP-5 research reactor, cadmium foils as analyzers, and an oxyhydrogen flame as the scattering gas. The transmissions of foils of thickness 0.002, 0.003, 0.004, ..., 0.015 inches were measured. Comparison with the computed transmissions was made by a ln t(d) vs. d plot, where t(d) is the transmission and d is the foil thickness. The theoretical total neutron scattering cross section of the flame is assumed to be the weighted sum of the scattering cross sections of the molecular constituents of the flame, H_2, O_2, H_2O, OH, H, and O; the weighting factor for each constituent is its partial pressure. The theoretical transmission as a function of flame temperature and foil thickness is given by

$$t(T,d) = \frac{\sum_{j=1}^{6} p_j \int_0 d\bar{E} \int_0 d\bar{E}_0 \int_\Omega d\Omega F(m_j,E,E_0,\theta,T) \exp[-nd\sigma(E)]}{\sum_{j=1}^{6} p_j \int_0 d\bar{E} \int_0 d\bar{E}_0 \int_\Omega d\Omega F(m_j,E,E_0,\theta,T)}$$

where, p_j is the partial pressure of the molecular constituent of the flame having mass m_j, nd is the number of atoms/cm^2 in the foil, $\sigma(E)$ is the total neutron cross section of cadmium, and $F(m_j,E,E_0,\theta,T) = \sigma'(m_j,E,E_0,\theta,T) \cdot C(E) \cdot N(E_0)$, where, C(E) is the BF_3 detector efficiency, and $N(E_0)$ is the energy distribution of incident neutrons, assumed to be Maxwell-Boltzmann. The integrals in t(T,d) were evaluated by the Gauss quadrature approximation using an IBM 650 computer. For air at room temperature the transmission of cadmium is a simple exponential function of foil thickness. The table below gives the results of a least-squares fit to both the measured and computed ln t(d) vs. d curves, $0 \le d \le 0.012$ inches and $\theta = 45°$.

Curve	y-intercept	Slope/Inch	Prob. Error in Slope
Measured	−0.118	−323.3	±3.2
Computed	−0.063	−325.4	±1.5

Using the flame as the scatterer, the energy distribution of the scattered neutrons is shifted to higher energies and the transmissions increase correspondingly, especially for the thicker foils. Interpreting the increase in transmissions in terms of temperature, and matching the measured transmissions with transmissions computed as a function of temperature, the temperature of a stoichiometric oxyhydrogen flame at 20 cm-Hg determined from neutron scattering data is (2800 ± 400)°K. The measured temperature quoted by Lewis and von Elbe (1951) for an atmospheric flame is 2760°K. (Dissertation Abstr.)

26158 CSR: THE CORNELL COUNTER-CIRCULATION STORAGE RING. Maury Tigner. Thesis, Ithaca, N. Y., Cornell Univ., 1963. 142p.

The design of a prototype 240 Mev electron-positron storage ring is presented. The instrument has an orbit radius of 45 centimeters and is designed to utilize a pulsed r-f cavity to capture electrons injected by pair production within the vacuum chamber. It is estimated that 10^7 particles might be captured and stored using a simple cavity configuration and the Cornell 1.3 Bev synchrotron as a source of gamma rays. Methods for increasing the number of stored particles are discussed. The results of preliminary trials of the magnet are given. Field measurements are presented and evidence for multiple traversals of the lattice by injected electrons is shown. Particle pair production and electron-positron elastic scattering are discussed as applications of the electron-positron storage ring to physics. (Dissertation Abstr.)

26159 MAGNETIC PROPERTIES OF THE HEXAGONAL ANTIFERROMAGNET $CsMnF_3$. Kenneth Lee. Thesis, Berkeley, Calif., Univ. of California, 1963. 131p.

The magnetic properties of $CsMnF_3$ have been investigated by magnetic susceptibility, torsion, electron resonance, and nuclear-antiferromagnetic double resonance. The single crystals were grown from the melt using a modified Stockbarger apparatus. A crystallographic analysis of this material confirmed the hexagonal structure with lattice constants a = 6.213 Å and c = 15.074 Å and space group $P6_3/mmc$. Torsion and electron resonance measurements have established that below 53.5°K $CsMnF_3$ is a hexagonal antiferromagnet with a large negative axial anisotropy. This is in contrast to $KMnF_3$ which is a canted antiferromagnet and $RbMnF_3$ which is a simple antiferromagnet at low temperatures. From the measurement of the perpendicular susceptibility at 4.2°K, an exchange field $H_E = 3.5 \times 10^6$ Oe was determined. From torsion measurements in the transverse plane a critical field $H_c \simeq 900$ Oe and a six-fold anisotropy $H_{A_2} = 1.1$ Oe and along the c axis an axial anisotropy $H_{A_1} = -7500$ Oe were determined. Assuming a magnetic spin model with the sublattice magnetizations lying in the transverse plane, low and high field expressions for the torque were determined and were found to be consistent with the experimental observations. The ⟨12.0⟩ directions were established to be the preferred axes. A calculation of the ligand field anisotropy arising

from the displacement of the nearest neighbor fluorines and a calculation of the classical dipolar interactions show a combined axial anisotropy of −7965 Oe. The six-fold anisotropy K_3 arising from second-order dipolar interactions was estimated to be ≈2 Oe. The two calculated fields are in reasonable agreement with the torque and resonance measurements. The temperature dependence of K_3 was observed from 4.2°K to the transition temperature and the regions where spin wave and molecular field theory appear to be valid were indicated. It was also observed that K_1/M^2 decreases much more rapidly with increasing temperature than expected from spin wave theory and that it is constant over a high temperature region in agreement with molecular field theory. Paramagnetic resonance measurements show a decreasing absorption and increasing line width as the temperature is lowered from 298°K to 63°K. This effect was also observed in other non-cubic antiferromagnets. An isotropic g value of 1.9989 ± 0.003 was determined in this region. Magnetic resonance measurements at 4.2°K show a six-fold anisotropy consistent with the torsion measurements. A half-width at half amplitude of 12 ± 3 Oe is observed which is about as narrow a resonance line as has been observed for an antiferromagnet. Due to the presence of the easy plane, the resonance out of the plane is found to be due only to the component of the static field in the plane. From 4.2°K to 0.3°K a large temperature dependent shift in the low frequency antiferromagnetic mode exists as expected. This shift is due to the temperature dependent anisotropy field α m determined to be equal to 9.15/T Oe. The two antiferromagnetic resonance frequencies were derived with H_0 in the plane and the normal modes and r-f susceptibility were discussed for the case where H_0 is applied perpendicular to the preferred axis. The results are in agreement with observations. The strong coupling between the nuclei and electrons afforded an opportunity to observe the ^{55}Mn nuclear resonance indirectly by monitoring the position of the electron resonance field. There exist two regions in which the electron resonance line could be shifted. In the first region a saturation of the nuclear magnetization occurs at 668 Mc/sec which is (3 ± 1) % lower than the calculated average hyperfine field of 689 ± 7 Mc/sec. This suggests the presence of zero point reduction in electron spin expected from spin wave theory. Expressions for the frequencies of the two nuclear modes were derived and it was shown that the low frequency mode is dominant as expected. The observed reduction in the nuclear resonance frequency with decreasing temperature is in excellent agreement with theory. As yet there is no clear understanding of the second region above 668 Mc/sec. (Dissertation Abstr.)

26160 MAGNETIZATION AND ELECTRICAL RESISTIVITY OF GADOLINIUM SINGLE CRYSTALS. Harold Eugene Nigh. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 144p.

A technique was developed for the growth of single crystals of gadolinium. The application of this technique to the other heavy rare-earth metals is discussed. The single crystals were prepared by annealing arc-melted buttons at temperatures somewhat below the melting point of the metal. Magnetic moment and electrical resistivity measurements have been made on three rectangular parallelepiped samples cut from the single crystals. The three samples were oriented with the long dimension parallel to the ⟨0001⟩ direction (c-axis), ⟨10$\bar{1}$0⟩ direction (b-axis), and ⟨11$\bar{2}$0⟩ direction (a-axis), respectively. Magnetic moment measurements were made in magnetic fields from 0 to 18 kOe at temperatures from 1.4 to 900°K. No evidence was found to indicate that an antiferromagnetic state exists in gadolinium. Anisotropic behavior was observed below the Curie temperature. It is concluded that the easy direction of magnetization is a function of temperature. The anisotropy is very small in fields greater than 3 kOe. A ferromagnetic Curie temperature of 293.2°K is reported. The absolute saturation magnetic moment obtained by extrapolation of a T^2 plot was found to be 268.4 cgs units per gram which corresponds to 7.44 Bohr magnetons per atom. This is to be compared with the theoretical value of 7.0 Bohr magnetons per atom obtained from $N_{eff} = gJ$. The saturation magnetization was observed to follow the $T^{\frac{3}{2}}$ law from 200 to 50°K with a deviation from this law observed below 50°K. The saturation magnetization fit the T^2 law rather well in the temperature region from 4.2 to 50°K; although a log-log plot of the low temperature data indicated the behavior as $T^{2.2}$. It was found that the spontaneous magnetic moment exhibited this same temperature dependence below 200°K. The temperature dependence of the spontaneous magnetic moment in the vicinity of the Curie temperature can be described by $\sigma_{O,T} = \sigma_{O,O}\,[1 - T/T_c]^{\frac{1}{2}}$. Curie-Weiss behavior was observed from 400 to 900°K in measurements on the a-axis and c-axis crystals. No anisotropy was observed above the Curie temperature. The experimentally determined paramagnetic Curie temperature was found to be 317°K and the effective Bohr magneton number in the paramagnetic region was found to be $\mu_{eff} = 7.98$, in excellent agreement with the theoretical value given by $\mu_{eff} = g[J(J+1)]^{\frac{1}{2}} = 7.94$. Electrical resistivity measurements were made from 4.2 to 380°K on the b-axis and c-axis crystals. For the current applied parallel to the b-axis it was observed that the resistivity exhibited a change in slope at 293.2°K, the Curie temperature. The c-axis resistivity exhibits a small maximum at 292°K and a shallow minimum at 340°K. The temperature dependence of the resistivity at low temperatures can be described by $\rho = AT^4$. (Dissertation Abstr.)

26161 PHOTOELECTRIC AND THERMIONIC SCHOTTKY DEVIATIONS FOR TUNGSTEN SINGLE CRYSTALS. David Francis Stafford. Thesis, St. Louis, St. Louis Univ., 1962. 111p.

The periodic Schottky deviations have been obtained for photoelectric and thermionic emission using the same single tungsten crystal as the emitting surface in a dual experiment. The thermionic deviations are compared with well established experimental results and theory, and serve as a check on the photoelectric work. The photoelectric deviations, not previously established experimentally in detail, are compared with theory. A composite theory, using Cutler-Gibbons thermionic parameters in Juenker's photoelectric analysis, is in best agreement with the experimental photoelectric results. The emitting surface was a clean (111) face of a tungsten single crystal. The observed thermionic deviations are in satisfactory agreement with latest theory and previous results, and the observed photoelectric deviations have approximately the same period and phase as the thermionic deviations. The experimental photoelectric deviation amplitude was found to be +1.7% at $E^{\frac{1}{2}} = 350$ (volts/cm)$^{\frac{1}{2}}$. (Dissertation Abstr.)

26162 THE HYDROGEN MOLECULE-ION AS A SUPERPOSITION OF ATOMIC ORBITALS. Allen Lowell Wasserman. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 203p.

Highly accurate electronic wave functions are found for a number of states of the hydrogen molecule-ion by expansions in terms of atomic orbitals on each of the nuclei. The accuracy attained is comparable to that of the best

solutions found by the separation of the differential equations. The states are the lowest $^2\Sigma_g$, $^2\Pi_u$, and $^2\Delta_g$ bonding states and the lowest $^2\Sigma_u$ and $^2\Pi_g$ antibonding states. The expansions are constructed from Slater type orbitals. Independent variation of all coefficients and all orbital exponents is permitted in order to obtain the energy minimum. The minimizations are carried out by a somewhat novel, convergent, iterative procedure. The fact that the lowest $^2\Delta g$ state is bound has not been previously known. It is shown to have a minimum at 9.8 Å and a binding energy of 0.36 kcal. Particular emphasis is placed on finding as concise expansions as possible. They are considered "significant expansions" for the purpose of carrying out an analysis of the binding energy according to a method proposed by K. Ruedenberg. The binding energy of the above mentioned states is decomposed into an energy of promotion, a quasi-classical electrostatic energy, and an interference energy. The analysis reveals that the energy lowering in bond formation is mainly due to a drop in kinetic energy from interference effects and a drop in potential energy due to contractive promotion. (Dissertation Abstr.)

26163 AN ELECTRONIC BAND SPECTRUM OF YTTRIUM MONOFLUORIDE. D. E. Mann (National Bureau of Standards, Washington, D. C.), N. Acquista, and M. J. Linevsky. 14p. (CONF-405-20)

From 4th Rare Earth Research Conference, Phoenix, Ariz., Apr. 1964.

A system of 19 double-headed red-degraded bands was observed in absorption in the range 3075 to 3300 Å when YF_3 was heated to about 2000°C in a King furnace. They were attributed to YF and a vibrational analysis was made. The constants determined from measurements on the R heads are (in cm^{-1}): $\nu_{00} = 31218.0$, $\omega_e'' = 633.5$, $\omega_e''x_e'' = 2.0$, $\omega_e' = 539.0$, $\omega_e'x_e' = 2.0$. A series of 10 diffuse bands in the range 2500 to 3000 Å was also seen in absorption. They were tentatively ascribed to YF_2. (auth)

26164 ON THE EMISSION OF ELECTRONS FROM SOLIDS IN GAS DISCHARGES. D. M. Speros and P. R. Buccilli. 11p. (CONF-364-9)

From 16th Annual Gaseous Electronics Conference, Pittsburgh, Oct. 1963.

A method for investigating the intrinsic behavior of cathodes in gas discharges, behavior ordinarily masked by temperature variations and discharge activity, is described. Circuits and results for measurements in zero-, accelerating-, and retarding-field regions are given. Application to low-pressure discharges led to: (1) determination of the zero-field condition, (2) expression of volt-ampere characteristics in terms of ln J as a function of $V^{1/2}$, and (3) correlation of cathode behavior in vacuum and gas discharges. (M.J.T.)

Accelerators

26165 (BNL-837(p.91-113)) THE CERN NEUTRINO BEAM. C. A. Ramm (European Organization for Nuclear Research, Geneva).

The principles of the production of the neutrino flux from charged π- and K-meson decay are reviewed. The design of the essential shielding against muons and neutrons is described. Experimental equipment—fast ejection equipment and the magnetic horn—are discussed and typical neutrino spectra are presented. (M.J.T.)

26166 (BNL-837(p.170-89)) THE ARGONNE-CHICAGO NEUTRINO EXPERIMENT AT THE ZGS. Valentine L. Telegdi (Chicago. Univ.).

Quasielastic neutrino reactions will be studied. The spark chamber detector, the anti-coincidence shield, the optical system, the electronic system, the general layout, and the Van der Meer focusing device are described and diagramed. (M.J.T.)

26167 (CERN-64-23) DESIGN AND CONSTRUCTION OF A 100-kG d.c. MAGNET. P. G. Innocenti and M. Morpurgo (European Organization for Nuclear Research, Geneva). May 1, 1964. 13p.

The magnet and its associated safety equipment are described. (R.E.U.)

26168 (CONF-401-2) HIGH-ENERGY ELECTRON ACCELERATORS. M. Stanley Livingston (Cambridge Electron Accelerator, Mass.). [nd]. Contract [AT(30-1)-2076]. 8p.

From the Institute of Electrical and Electronics Engineers 1964 International Convention, New York, Mar. 1964.

The Cambridge Electron Acceleration, a 6-Bev synchrotron, is described. Its magnets and r-f resonant cavities are discussed. (R.E.U.)

26169 (NP-13973) OBTENCIÓN EN SINCROCICLOTRÓN DE TRAZADORES DE PLUTONIO. INFORME NO. 86. (Obtaining of Plutonium Tracer in a Synchrocyclotron. Report No. 86). M. B. Crespi, G. A. Dupetit, and R. T. Bonard (Argentina. Comisión Nacional de Energia Atómica, Buenos Aires). 1963. 11p.

The optimum conditions to obtain plutonium tracer from natural uranium in a cyclotron were established. It was found that the yield is maximum at 24.5 Mev and that the amount obtained with targets of 27 mg/cm^2 is enough for tracer uses (approx. 1.5×10^{-3} $\mu c/\mu amp.\ hr\ cm^2$). As the plutonium obtained is mainly ^{236}Pu, of 2.7 years halflife, its use in chemical studies, whether in carrier-free condition or as spiker of common reactor-produced plutonium, permits increasing the sensitivity of the detection of the element and diminishing the hazard associated with its handling. (auth)

26170 (UCRL-10869) BERKELEY STUDY FOR A PROTON SYNCHROTRON IN THE 150-300 Gev RANGE. Lloyd Smith (California. Univ., Berkeley. Lawrence Radiation Lab.). Aug. 9, 1963. Contract W-7405-eng-48. 15p. (CONF-114-27)

From the International Conference on High Energy Accelerators, Dubna, U.S.S.R., Aug. 1963.

A design study of an alternating-gradient proton synchrotron of up to 300 Bev initiated at LRL is presented. (R.E.U.)

26171 (AEC-tr-6372(p.511-20)) POWER FLUCTUATIONS OF THE VAN DE GRAAFF ELECTRON ACCELERATOR. Kenichi Shinohara and Tomomichi Shigematsu. (Translation)

Power fluctuations that take place when the Van de Graaff electron accelerator is used for radiation chemistry purposes are discussed along with the degree of the variations and measures to reduce them. A Van de Graaff accelerator that uses corona discharge to divide voltage depends on the discharge for power stabilization. Raising the corona current decreases the beam current, and the spray current, i_s, and filament current have to be raised to increase i_b. In actual operation i_b should not be raised beyond 100 μA. Therefore, installation of a corona point at the terminal is desirable when power stabilization beyond this stage is required. The corona point should be effective to within 2.0%. The use of an inductance coil is thought to be quite effective and will not be affected by gas pressure. The accelerator with power regulation to

within ±2.0% is considered highly adapted for use in radiation chemistry studies. (P.C.H.)

26172 SOLVING THE PROFILE EQUATION OF A NORMAL BEAM. P. P. Starling (Rutherford High Energy Lab., Chilton, Berks, Eng.). J. Nucl. Energy, Pt. C, 6: 299(May-June 1964).

A change of variables is used for a previously proposed equation for the normalized profile of a beam with space charge and emittance so that the equation can be integrated numerically by the Runge-Kutta method. (C.E.S.)

26173 CONSTRUCTION OF THE COMPLETE PLANT OF LINEAR ACCELERATOR BY GUTEHOFFNUNGSHÜTTE. Kerntechnik, 6: 170-1(Apr. 1964). (In German)

An installation is being built for a 240-Mev-electron linear accelerator. Progress is reported and diagrams shown. (M.C.G.)

26174 THE RELATIVISTIC ISOCHRONOUS CYCLOTRON DEVELOPED BY AEG. Kerntechnik, 6: 171(Apr. 1964). (In German)

Design development for the AEG relativistic isochronous cyclotron for deuteron acceleration at variable energies between 45 and 90 Mev is described. The arrangement of the h-f acceleration system is discussed and its performance evaluated. (M.C.G.)

26175 UTILIZATION OF THE L.F.E.N. VAN DE GRAAFF ACCELERATOR IN A STUDY OF INDUSTRIAL RADIOGRAPHY. E. N. Teles Pimenta (Laboratorio de Fisica e Engenharia Nucleares, Sacavem, Portugal). Rev. Port. Quim., 4: 133-49(Dec. 1962). (In Portuguese)

Exposure curves for two films were obtained in order to apply the Van de Graaff accelerator to industrial radiography. The properties of the films were determined. The radiation energy value and the elimination of the scattered radiation are discussed in order to obtain the best experimental conditions. (auth)

26176 NANOSECOND PULSING FOR VAN DE GRAAFF ACCELERATORS. C. D. Moak, W. M. Good, R. F. King, J. W. Johnson, H. E. Banta, J. Judish, and W. H. duPreez (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr., 35: 672-9(June 1964).

A pulsed ion source of delivering 10-mamp proton bursts with durations of approximately 1 nsec is described. Critical design constraints are discussed and used to illustrate the general procedure for meeting various experimental requirements. The system consists of a duo-plasmatron ion source, a lens-chopper combination, and a klystron buncher which uses the entire accelerator as a drift path to produce bunched ion bursts at the target. An external diverter system is used to vary the repetition rate from 10^6 down to 3×10^4 sec^{-1}. (auth)

26177 REDUCED ENERGY SPREAD OF SYNCHROCYCLOTRON BEAMS. K. Gotow, K. F. Kinsey, F. Lobkowicz, M. E. Nordberg, N. W. Reay, and E. H. Thorndike (Univ. of Rochester, N. Y.). Rev. Sci. Instr., 35: 755-6(June 1964).

The energy spread due to radial oscillations is eliminated by turning the radiofrequency off and using a moving target. By increasing vertical oscillations with a lip on the target, solid targeting is achieved; and the energy spread due to target thickness is reduced. (auth)

26178 APPROXIMATION METHOD FOR CALCULATING THE FOCUSING SYSTEM OF TWO QUADRUPOLE MAGNETS. N. I. Venikov and E. S. Mironov. Zh. Tekhn. Fiz., 34: 530-5(Mar. 1964). (In Russian)

A simplified optical method was used for calculating a focusing system consisting of two quadrupole magnets. Graphs for determining basic parameters of magnets for actual focusing are compared to graphs for virtual focusing. The comparison of calculations made by the suggested method with calculations using differential equations for ion motion in a magnetic field showed identical results for $(L/l_0) \ll 1$ and $(L/d) \ll 1$. For $(L/l_0) \ll \frac{1}{3}$ and $(L/d) \ll \frac{2}{3}$ the error did not exceed 10%. (R.V.J.)

26179 ON THE RADIAL MOTION OF PARTICLES IN AN ACCELERATOR DURING BEAM EXTRACTION WITH A REGENERATIVE DEFLECTOR. Yu. Ya. Lembra (Tartur State Univ., USSR). Zh. Tekhn. Fiz., 34: 567-75(Mar. 1964). (In Russian)

A matrix method used for resolving equations for betatron oscillations was used in an investigation of radial particle motions in beam extraction by a regenerative deflector. The analysis was made for an accelerator with particles moving in periodic magnetic systems. The analysis was carried out for deflector operation in each revolution and in alternate resolutions. (R.V.J.)

26180 EFFECTS OF FIELD CLUSTER ON PHASE OSCILLATIONS OF PARTICLES IN CYCLIC ACCELERATORS. A. N. Didenko and Yu. A. Salivon. Zh. Tekhn. Fiz., 34: 654-7(Apr. 1964). (In Russian)

The motion of particles in a cyclic accelerator waveguide was studied considering the external field and the proper field of the cluster. The field created by a moving cluster in a closed iris waveguide along a large radius was calculated with the assumption that the cluster particles have only an azimuthal component of velocity and the dimensions of the cluster are considerably smaller than the length of the wave in the waveguide. (R.V.J.)

26181 THE ELECTROMAGNETIC FIELDS EXCITED IN ACCELERATOR CAVITIES BY A BEAM OF CHARGED PARTICLES. Frank Joseph Kriegler. Thesis, Madison, Wis., Univ. of Wisconsin, 1963. 117p.

A method is given for the determination of the electromagnetic fields excited in accelerator cavities by a bunched beam of charged particles passing through the cavity. The electric and magnetic fields within the cavity are determined by solving a coupled regions problem of a coaxial cavity coupled through a gap to a cylindrical waveguide. The expressions for the fields are expanded in a Fourier-Bessel series in each region of the accelerator cavity: (1) cylindrical cavity region, and (2) coaxial cavity region. The Fourier coefficients in these expansions are the Fourier integrals of the unknown longitudinal electric field in the gap. By requiring the magnetic field to be continuous at the gap an integral equation is obtained for the longitudinal electric field in the gap. The basic method of solution of this integral equation depends upon approximating the longitudinal electric field in the gap by a piecewise continuous linear function of unknown slopes, a_j. The Fourier integral of the unknown gap field is replaced by the Fourier integral of this linearized gap field. This reduces the integral equation to an algebraic equation which is a linear function of the unknown slopes, a_j. A set of linear simultaneous equations is then obtained from which the unknown slopes are determined. This method gives a good approximation to the longitudinal electric field in the gap. The magnitudes of the fields for varidus resonances of accelerator cavities having finite conducting walls are obtained by using an equivalent impedance. The derivation of this impedance is based on normal mode theory for cavities. This impedance corresponds to an infinite number of parallel RLC circuits connected in series. Application of the

general theory to numerical investigation is limited to a linear accelerator cavity with drift tubes. The results of the numerical studies are presented as a series of normalized curves. These numerical results are directed toward obtaining values for pertinent electrical quantities for the fundamental resonance of linear accelerator cavities. The general method of analysis and the resulting expressions presented also enable determination of the electromagnetic fields excited in geometrical configurations representing klystrons, circular accelerators with large radii of curvature, and linear accelerators with irises. (Dissertation Abstr.)

26182 IMPROVEMENTS IN OR RELATING TO ACCELERATION OF CHARGED PARTICLES. James Tychon Serduke. British Patent 957,863. May 13, 1964. Filed June 17, 1960.

An apparatus is designed for the acceleration of charged particles by direct current accelerating potentials alone. Thus, the disadvantages of accelerators using oscillating fields are avoided, and higher energies can be obtained. The apparatus comprises a gapped path formed by separated tubular shield members for guiding and focusing the particles, complementary accelerating rings to provide in conjunction with the shield members electrode pairs on opposite sides of the gaps, and means for applying d-c potentials to the electrode pairs to establish an accelerating field. Several embodiments of the apparatus (called the DC-Tron) of the linear and arcuate orbit type are described. (D.L.C.)

26183 IRIS LOADED WAVE GUIDE FOR AN ELECTRON LINEAR ACCELERATOR. Germain Vincent and Hubert Leboutet (to Compagnie Generale de Telegraphie sans Fil). German Patent 1,164,583. Mar. 5, 1964. Priority date June 25, 1957, France.

The linear accelerator comprises a single wave guide the parameter of which is chosen in such a way that the traveling wave is simultaneously accelerating a first electron beam and generating the oscillations by mutual interaction with a second electron beam. Both electron beams are directed parallel to the wave guide but in opposite directions. (Gmelin Inst.)

26184 AMPLIFIER APPARATUS FOR HIGH ENERGY PARTICLE ACCELERATORS. R. H. Rheaume, R. E. Zider, and F. A. Janik (to U. S. Atomic Energy Commission). U. S. Patent 3,129,591. June 30, 1964.

A high power, broad band video frequency amplifier is designed for producing a linear amplitude and phase response to a low impedance and/or single ended input signal. This amplifier comprises at least two different amplification stages utilizing low power multigrid tubes which provide economy and dependability, and high power triodes which keep output cable termination perturbations from tailing back. In between these stages is a ferrite cored interstage inductor which provides high stage gains, good impedance match between low and high impedance stages, smoothness of phase-frequency response over a wide video frequency band, and a precise LC filter interstage network. These inductors comprise autotransformers and/or chokes with high side-to-side coupling coefficients and tuning adjustment means. (AEC)

26185 MAGNETIC DEFLECTION SYSTEM PROVIDING PLURAL EXIT PORTS FOR A BEAM OF CHARGED PARTICLES. Stanley Ernest Hunt (to Associated Electrical Industries Ltd.). U. S. Patent 3,135,863. June 2, 1964. Priority date Feb. 9, 1961, Great Britain.

A magnetic deflection system for an accelerator that is capable of deflecting the beam through a 90° angle is presented. The beam focal length is variable, and the system is capable of separating and focusing particles of different masses. (C.E.S.)

26186 PLURALLY CHARGED ION BEAM GENERATION METHOD. James Adolf Weinman. U. S. Patent 3,136,908. June 9, 1964. Filed July 28, 1960.

A method and an electrostatic accelerator structure are described for producing high intensity beams of multiply charged positive ions of atomic number from 2 to 20. The method comprises forming thermal neutral atoms, ionizing the atoms, accelerating the ions, adding electrons to the ions to form a beam of fast neutral atoms, removing more than one electron from the atoms, and finally accelerating the ions. The ion source is located outside the accelerator enclosure. (D.L.C.)

Astrophysics and Cosmology

26187 (BNL-837(p.193-233)) ASTROPHYSICS AND FUNDAMENTAL NEUTRINO INTERACTIONS. M. Ruderman (New York Univ., New York).

Knowledge that can be gained from astronomical measurements and astrophysical models about the interaction of the neutrino with other elementary particles is considered. Electromagnetic properties of neutrinos, the electron-neutrino interaction, neutrino emissivities, stellar evolution, and pre-supernova stars and nuclear abundances are discussed. (M.J.T.)

26188 (SUI-63-37) FURTHER OBSERVATIONS ON THE STARFISH AND SOVIET ARTIFICIAL RADIATION BELTS. J. A. Van Allen (Iowa. State Univ., Iowa City). Nov. 1963. Contract N9onr-93803. 39p. (N64-13057; NASA-CR-55187)

The peak intensity of electrons in the Starfish belt was initially $J_0 \sim 1.4 \times 10^9/cm^2/sec$ at $L = 1.18$ on the Equator. By June and July 1963, one year later, it was $J_0 \leq 1.5 \times 10^8/cm^2/sec$ at $L = 1.35$ on the Equator. The mean lifetime of ~2-Mev electrons at the most durable portion of the Starfish belt ($L \sim 1.35$) is about 16 months. About 10% of initially injected electrons (dominantly the higher energy ones) remained trapped at the end of one year. A preliminary report on the time history of two of the three artificial radiation belts produced by Soviet high-altitude atomic bursts in October and November 1962 is given. The mean lifetime of electrons of $E > 250$ kev was of the order of 25 days for $2.4 \leq L \leq 3.6$. At $L \geq 3.6$ there were marked natural fluctuations. Thus, in agreement with previous evidence, it is confirmed that trapping lifetimes increase rapidly with increasing altitude (due to diminishing atmospheric density), have a maximum of the order of a year at $L \sim 1.4$, then decline to values of the order of days to weeks at $L \gtrsim 2.0$ (due to magnetic and electromagnetic perturbations). (auth)

26189 COSMIC RAY AGES OF METEORITES. D. C. Hess (Argonne National Lab., Ill.). Argonne Natl. Lab. Rev., 1: 5-11(Apr. 1964).

Types of meteorites and their frequencies of occurrence are noted. Methods for estimating meteorite ages are reviewed. Correlations between results of various age-estimation methods are discussed. The relative reliabilities of the methods are summarized. (T.F.H.)

26190 EXTENDED RADIO SOURCES. [PART] I. D. K. Milne and P. A. G. Scheuer (CSIRO, Chippendale, New South Wales, Australia). Australian J. Phys., 17: 106-27 (Mar. 1964).

Twenty-one extended sources were observed with a 14′ arc pencil beam at 1400 Mc. Some appear to be irregularities in the galactic radio emission, but most, especially those at high galactic latitudes, are resolved into groups of sources of small angular diameter. Maps of the regions are shown, and so far as possible radio spectra of the component sources were assembled. An optical identification is given for the principal component of MSH 00−017 (3C29), and tentative identifications are suggested for some other sources. (auth)

26191 A SKY SURVEY OF NEUTRAL HYDROGEN AT λ 21 CM. III. GAS AT HIGHER RADIAL VELOCITIES. R. X. McGee and Janice A. Milton (CSIRO, Chippendale, New South Wales, Australia). Australian J. Phys., 17: 128-57(Mar. 1964).

Information is presented concerning the distributions of the intensity and radial velocity of atomic hydrogen gas at radial velocities away from zero. The observations were made with an aerial beam of 2.2° between half-power points and a multichannel H-line receiver of channel spacing equivalent to 7 km/s and bandwidth 38 kc (≈8 km/s). The gas at the higher velocities is found in the galactic latitude range $b^{II} = \pm 10°$ arrayed in a number of spiral arms. The simply reduced observational data are compared with the refined reductions of previous workers in the case of the outer ($R > R_0$) arms. It is shown that, if use is made of the radial velocity-distance models at present accepted, the principal elements of the gaseous spiral arms are clouds of enormous size. The size of the clouds and hence the thickness of the spiral arms apparently increases markedly with distance from the galactic center greater than solar distance (R_0). The masses of these large clouds remain fairly uniform at $\sim 10^7 M$. (auth)

26192 PRECISE MEASUREMENTS OF THE RADIATION FROM THE MOON AND SUN AT A 4 MILLIMETER WAVELENGTH. A. G. Kislyakov and V. M. Plechkov (Gor'kii State Univ., USSR). Izv. Vysshikh Uchebn. Zavedenii, Radiofiz., 7: 46-50(1964). (In Russian)

Measurements were conducted in August−September 1962 in the high-altitude area of the Pamirs (3860 m above sea level). Lunar and solar radiations were compared with radiation from a black disk of known angular dimensions. The brightness temperature of the sun for the 4 mm wavelength turned out to be 7300 ± 200°K. At this wavelength, the phase dependence of lunar radiation is well described by the law $\overline{T_m} = [204 + 56 \cos(\phi - 23°)]$°K, where $\overline{T_m}$ is the average brightness temperature of the moon disk and ϕ is the moon phase, timing from the full moon. The error in the measurement of $\overline{T_m}$ is less than 4%. The experimental results were used to estimate the radio emissivity of the moon's soil and to calculate the phase dependence of the radio emission from the center of the lunar disk. (auth)

26193 OPTICAL CHARACTERISTICS OF COSMIC-RAY AND PROTON FLARES. Anton Bruzek (Air Force Cambridge Research Labs., Sunspot, N. Mex.). J. Geophys. Res., 69: 2386-7(June 1, 1964).

An examination of data on some proton and cosmic-ray flares occurring in the period 1959−1961 showed that all the cosmic-ray flares and 95% of the proton flares were associated with the occurrence of a loop prominence. (D.C.W.)

26194 21-CM ABSORPTION PROFILES FOR AN EXPANDING GAS CLOUD. A. Smith (Univ. of Manchester, Eng.). Monthly Notices Roy. Astron. Soc., 127: 347-53 (1964).

Theoretical absorption profiles are constructed for a one-dimensional hydrogen cloud expanding anisotropically along the interstellar magnetic field lines. In this model the motion of the neutral hydrogen is controlled by carbon ions at a density 10^{-4} that of H atoms. It is pointed out how the profiles may be misinterpreted as those due to more than one non-expanding cloud situated between the observer and source. (auth)

26195 PARTICLE ACCELERATION IN CISLUNAR SPACE. A. G. W. Cameron (Goddard Inst. for Space Studies, New York). Nature, 202: 785(May 23, 1964).

An explanation is given for the observation of an enhanced red emission from the vicinity of the crater Kepler. The duration of the red glow was of the order of 10 min or longer, and it appeared twice within a 2-hr period. It is expected that such luminescence will occur principally at times near Full Moon and during unusually large activity on the Earth. The phenomena suggested are of a complex character. (P.C.H.)

26196 QUASI-STELLAR RADIO SOURCES AS SPHERICAL GALAXIES IN THE PROCESS OF FORMATION. G. B. Field (Princeton Univ., N. J.). Nature, 202: 786-7(May 23, 1964).

It is suggested that energy release of the magnitude and time-scale required for the formation of quasi-stellar radio sources might be the natural consequence of the formation of a spherical galaxy through the contraction of an intergalactic gas cloud. If it is assumed that from time to time such gas clouds become gravitationally unstable, the ensuing contraction may be described approximately as the radial free fall of a uniform sphere, at least until such a time that the centrifugal forces accompanying rotation of the cloud prevent further contraction. Reasons for the suggestion are outlined. (P.C.H.)

26197 RADIOGENIC, SPALLOGENIC, AND PRIMORDIAL RARE GASES IN STONE METEORITES. H. Hintenberger, H. Koenig, L. Schultz, and H. Waenke (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 19a: 327-41 (Mar. 1964). (In German)

The total content and the isotopic composition of helium and neon of 47 stone meteorites were determined. The concentrations of ^3He, ^4He, ^{20}Ne, ^{21}Ne, and ^{22}Ne are presented in tables. For meteorite samples without primordial rare gas content, the radiogenic component of ^4He was calculated by subtracting the fourfold amount of ^3He from the total ^4He in order to allow for the spallation fraction of ^4He. From radiogenic ^4He the U−Th−He ages of the investigated meteorites were calculated using an average uranium content of 1.1×10^{-6} g/g (except those cases where uranium determinations existed) and a 3.5 fold amount for thorium. The cosmic-ray-exposure ages were calculated using the average production rates for ^3He and ^{21}Ne derived from the decay rate of tritium and ^{22}Na measured in some meteorites. The calculated values for the exposure ages were between 0.5×10^6 and 40×10^6 years. Some of the meteorites showed very low $^3He/^{21}Ne$ ratios, which indicated diffusion loss of the spallogenic rare gases. The results indicated differences in the distribution of the U−Th−He ages as well as of the cosmic-ray-exposure ages between the chondrites of the low iron group (L) and the chondrites of the high iron group (H). On the average the U−Th−He ages of the H group chondrites were considerably higher than those of the L group. In fact, there were only a few H group chondrites with low U−Th−He ages, and for most of these exceptions it is shown that they lost their radiogenic ^4He during the time of cosmic-ray exposure. The cosmic-ray-exposure ages of the H group

chondrites were below 10 million years in 74% of the cases, while for those of the L group only 40% were below this value. Investigations on the 47 meteorites also disclosed two additional meteorites (Pultusk and Vigarano), which exhibit a high content of light primordial rare gases, as was earlier found for Pantar, Breitscheid, and Tabor. (auth)

26198 RADIATION AGES OF SOME IRON METEORITES. H. Voshage and D. C. Hess (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 19a: 341-6(Mar. 1964). (In German)

By continuing investigations described earlier, the cosmic-ray-exposure ages of eight iron meteorites were determined using the $^{40}K/^{41}K$ method. The results are: Canyon Diablo 655 ± 65 Myrs, Dayton 215 ± 85 Myrs, Grant 695 ± 55 Myrs, Morradal 155 ± 95 Myrs, Norfolk 680 ± 55 Myrs, Norfork 605 ± 75 Myrs, Piñon 695 ± 125 Myrs, and Washington County 610 ± 70 Myrs. (auth)

26199 HIGH-DENSITY BEHAVIOR AND DYNAMICAL STABILITY OF NEUTRON STAR MODELS. C. W. Misner and H. S. Zapolsky (Univ. of Maryland, College Park). Phys. Rev. Letters, 12: 635-7(June 1, 1964).

Common features of a variety of models for cold neutron stars in hydrostatic equilibrium, covering qualitatively the whole range of possibilities for core models onto which the relatively thin atmospheres discussed in previous model atmosphere calculations can be joined, are reported. The existence and value of a maximum mass which can exist in cold static equilibrium are discussed, and it is argued that dynamically stable solutions exist for all masses below this maximum. (M.J.T.)

26200 X-RAY ASTRONOMY. Herbert Friedman. Sci. Am., 210: No. 6, 36-45(June 1964).

The observations of two powerful x-ray sources in Scorpius and the Crab nebula are discussed, together with the possibility that the x rays originate in the superdense cores of "neutron stars" resulting from the collapse of supernovae. The evolution of such a star, other hypothetical mechanisms for x-ray production, the prediction of neutron star models, and other uses of x-ray astronomy are considered. (D.C.W.)

26201 THE COSMIC ABUNDANCES OF THE ELEMENTS. H. E. Suess (Univ. of California, La Jolla). p.28-37 of "Summer Course on Nuclear Geology." [Pisa, Italy, Comitato Nazionale per l'Energia Nucleare, 1960].

Cosmic abundances of the elements and their isotopic compositions, as found in meteorites, are reviewed. Results indicate that a more regular trend of the abundance values of the elements as a function of atomic weight can be obtained by correcting the abundance values of the individual elements, and that the minute traces of the heavy rare gases included in the meteorites represent the only materials showing signs of incomplete mixing. (auth)

26202 THE ABUNDANCE OF LITHIUM, BERYLLIUM, AND LEAD IN THE SOLAR ATMOSPHERE. Joseph Paul Mutschlecner. Thesis, Ann Arbor, Mich., Univ. of Michigan, 1963. 208p.

A study has been undertaken to develop computer programs and measurement techniques applicable to the determination of abundances of elements in the solar atmosphere or the atmospheres of solar-like stars. Emphasis is placed upon the problems of abundance determination for elements with very weak absorption lines. Computer programs are developed for the calculation of continuous absorption coefficients in atmospheres of the solar type, including procedures for the empirical determination of the continuous absorption due to unspecified agents. Another program is given for the calculation of partition functions. A new semi-empirical solar model atmosphere is derived for use in the calculations; this model results from several observationally determined temperature distributions published by other authors. Using this model, detailed studies have been made of the possible errors in the theoretical curve of growth due to uncertainties in the model, the absorption coefficients, and other parameters. The procedures developed in the study have been applied to the determination of the abundance of lithium, beryllium, and lead in the solar atmosphere; these are of particular interest in connection with problems in nucleogenesis and solar structure. The number of atoms per million silicon atoms are found to be 1.1 for lithium, 6.9 for beryllium, and 1.4 for lead. The results are in reasonably good agreement with previous determinations with the exception of that for lithium which is about twice as abundant as previously found. It is concluded that the procedures developed should be useful for the determination of abundances of other elements, particularly those with weak absorption lines. It is not believed possible to relate the derived lithium or beryllium abundances to the solar interior model at present due to the uncertainties in the convective structure of the sun during its early history. The lead abundance, it is concluded, lends support to the s-process theory of nucleogenesis. (Dissertation Abstr.)

Atomic Physics

Refer also to abstracts 26555, 26587, 26588, and 26806.

26203 (NASA-TN-D-2145) THEORY OF THE 2s AND 2p EXCITATION OF THE HYDROGEN ATOM INDUCED BY ELECTRON IMPACT. Kazem Omidvar (National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.). June 1964. 47p.

A numerical calculation was carried out to evaluate the 3 × 3 cross-section matrix involved in the electron impact excitation of the ground state of a hydrogen atom to the 2s and 2p levels. The method of solution is that of atomic eigenstates expansion. Instead of the iterative technique used by others, the definite integral terms in the coupled radial differential equations are eliminated through some linear transformation of the radial functions, thus avoiding iteration of these equations. The accuracy of the numerical integration is tested by satisfying the equation of reciprocity and the equation of continuity of currents with an error-to-value ratio less than 1 per 1000 on the average; and the maximum of this ratio, except for a few cases, has been kept below 5 percent. The results are in agreement with the results of an iterative technique. To evaluate the effect of the long-range and the centrifugal potential, a simple perturbation theory is developed. The six cross sections 1s → 2s, 1s → 2p, 1s → 1s, 2s → 2s, 2s → 2p, and 2p → 2p are tabulated. The 2p → 2p cross section requires the solution of the sets of differential equations with different parities. With the validity of the eigenstates expansion assumed, it is found by comparison with the eigenstates expansion calculation that the Born approximation, despite its simplicity, gives meaningful results for low and close-to-the-threshold energies of the bombarding electrons. The effect of the exchange potentials on the cross sections is also investigated. An interesting structure of the 1s → 2s excitation cross section above threshold is found. (auth)

26204 IONIZATION AND DISSOCIATION OF POLYATOMIC MOLECULES. William A. Chupka. Argonne Natl. Lab. Rev., 1: 15-18(Apr. 1964).

Charge-exchange and electron-impact ionization and dissociation of n-butane are studied in the statistical model, and the theoretical predictions are compared with experimental results. (T.F.H.)

26205 ABSOLUTE INTENSITIES OF CHARACTERISTIC Kα RADIATION FROM AN INCLINED COPPER TARGET. V. Metchnik (Univ. of Adelaide). Australian J. Phys., 17: 45-9(Mar. 1964).

Experimental results are given for the measurements of the absolute intensity of characteristic Kα radiation from a thick copper target when the normal to the target is inclined to the incident electron beam at an angle θ equal to 20, 30, 40, and 50°. These measurements cover a range of electron energies between 20 and 50 kv, and take-off angles ϕ ranging from 1 to 50°. A comparison is made with the emission at normal incidence. The copper Kα radiation was isolated by means of balanced nickel and iron filters, and the intensity measurements were made with a scintillation counter with NaI(Tl) crystal. (auth)

26206 INTERACTION OF SLOW ELECTRONS WITH CHEMISORBED OXYGEN. P. A. Redhead (National Research Council, Ottawa). Can. J. Phys., 42: 886-905(May 1964). (NRC-7822)

Measurements were made of the effects of low-energy electron bombardment (0–300 ev) on a chemisorbed layer of oxygen on polycrystalline molybdenum. Oxygen is adsorbed in two states at room temperature with approximate heats of adsorption of 60 and 110 kcal/mole, respectively. O^+ ions are released from the weakly bound state with a maximum probability of 10^{-5} ion/electron at an electron energy of 90 ev. The ion-energy distribution, measured by a retarding-field method, has a maximum at about 6 ev and a half width of 5 ev. About 50 neutrals are released for every ion. The measured threshold energy, 17.6 ± 0.2 ev, for ion formation is in good agreement with the calculated value. The probability of ion and neutral release from the strongly bonded state is about 5×10^{-4} of that for the weakly bonded state. A qualitative explanation of the formation of neutrals is proposed in terms of Auger neutralization of the ions near the surface. Reflection of the ion-energy distribution in the calculated curve of the potential energy of the O^+ ion yields, after correction for Auger neutralization, the probability density distribution of the adsorbed oxygen atom. The equilibrium spacing of the chemisorbed atom is then estimated to be 1.67 Å. (auth)

26207 THE EFFECT OF VIBRATIONAL EXCITATION OF H_2^+ ON ITS COLLISION-INDUCED DISSOCIATION. J. Wm. McGowan and Larkin Kerwin (Université Laval, Quebec). Can. J. Phys., 42: 972-9(May 1964).

The production of fast protons resulting from the dissociation of H_2^+ in collisions with H_2 was studied. Ion energies between 0.6 and 2 kev are considered. For fixed ion energy, a direct relation is observed between the relative population of the vibrational levels (a function of the ionizing electron energy) and the cross section. As the electron energy is increased, the relative population of the upper states is increased, thus giving rise to a marked increase in total cross section. Several mechanisms of ion collisional dissociation result. One type involves a vertical Franck–Condon transition between electronic states; the other appears to involve a diagonal transition which may occur when Franck–Condon conditions do not apply. (auth)

26208 NOTE ON M 4 TRANSITIONS. S. M. Brahmavar and M. K. Ramaswamy (Karnatak Univ., Dharwar, India). Current Sci. (India), 33: 43-4(Jan. 20, 1964).

Data on M 4 transitions were tabulated for the type $g_{\frac{9}{2}} \rightleftharpoons p_{\frac{3}{2}}$ (Group A) and $h_{\frac{11}{2}} \rightleftharpoons d_{\frac{5}{2}}$ (Group B). The isotopes include ^{87}Sr, ^{113}In, ^{115}In, ^{69}Zn, ^{89}Y, ^{91}Y, ^{131}Xe, ^{133}Ba, and ^{193}Ir. Examples where the odd-proton value is much larger than twice the neutron value expected from previous estimates were found. Configuration mixing calculations cannot be expected to explain the observations. (P.C.H.)

26209 TUNNEL EFFECT AND QUANTUM DISTRIBUTION OF ENERGY OF THE ELECTROCHEMICAL DISCHARGE OF PROTONS AND DEUTERONS. S. G. Christov (Inst. of Physical Chemistry, Academy of Sciences, Sofia). Electrochim. Acta, 9: 575-85(May 1964). (In German)

The role of the tunnel effect in electrode processes was studied assuming a quantum distribution of the vibrational energy of the $H^+ - OH_2$ bond. The calculations were carried out using a recently found expression for the permeability of a generalized Eckart barrier. It was found that the parameters of the barrier do not differ much from those determined previously. It is also shown that practically all particles penetrate this barrier at the quantum level n = 2 (for protons) or n = 3 (for deuterons). Actually the energy levels correspond approximately to the mean values of the energy of the protons or deuterons penetrating the barrier because the strictly quantized energy spectrum is strongly smeared out due to the interactions of the particles in the solution. (P.C.H.)

26210 GASEOUS ION RECOMBINATION RATES. [PART] II. Bruce H. Mahan and James C. Person (Univ. of California, Berkeley). J. Chem. Phys., 40: 2851-9 (May 15, 1964). (UCRL-11084)

An analysis of the mechanics of three-body ion recombination is given. The relative efficiencies of various gases in promoting ion recombination are calculated and found to be in satisfactory agreement with experiment. The calculations lead to qualitative conclusions about how mass, relative velocity, and the nature of the deactivation criterion affect the magnitude of the recombination rate. (auth)

26211 EIGENFUNCTIONS OF THE ELECTRON SPIN OPERATORS. Don Secrest and Lloyd Martin Holm (Univ. of Illinois, Urbana). J. Math. Phys. (N. Y.), 5: 738-42 (June 1964).

The problem of finding linear combinations of Slater determinants that are eigenfunctions of both the S^2 and S_z operators is considered. The method of projection operators is used in forming eigenfunctions of S^2. A recursion relation is given for the coefficients in the linear combination. Rules are given for selecting a complete linearly independent set of eigenfunctions, and an explicit formula is given for the members of the set. (auth)

26212 THEORY OF SCATTERING IN SOLIDS. Joseph Callaway (Univ. of California, Riverside). J. Math. Phys. (N. Y.), 5: 783-98(June 1964).

The general theory of the scattering of excitations in solids by localized imperfections is discussed. The solid-state analog of the usual partial-wave expansion of the scattering amplitude is derived. The applicability of the general theory to phonons and spin waves as well as electrons is demonstrated. (auth)

26213 THE HYPERFINE AND ISOTOPIC STRUCTURE OF THE 5535 Å LINE OF BaI. V. Draganescu, N. Komanichu, V. Tatu, and N. Zh. Ionescu-Pallas (Inst. of Atomic

Physics, Bucharest). Opt. Spectry. (USSR) (English Transl.), 16: 101-3(Feb. 1964).

The hyperfine and isotopic structure of the 5535 Å line of BaI was investigated theoretically and experimentally. (auth)

26214 EFFECTIVE CROSS SECTIONS FOR THE EXCITATION OF BALMER SERIES HYDROGEN LINES IN COLLISIONS OF SINGLY CHARGED HELIUM AND NEON IONS WITH HYDROGEN MOLECULES. E. P. Andreev, V. A. Ankudinov, and S. V. Bobashev. Opt. Spectry. (USSR) (English Transl.), 16: 103-6(Feb. 1964).

An optical method was used to measure the cross sections for excitation of the first five lines of the Balmer series of atomic hydrogen in collisions of 5–35 kev He^+ and Ne^+ ions with H_2 molecules. It was found that the cross section for excitation by Ne^+ ions increases with the energy of the ions, but that the cross section for excitation by He^+ ions is practically independent of the energy of the ions. The excitation of the same line by He^+ ions is about twice as efficient as by Ne^+ ions of the same velocity. In both cases, the excitation of H_ϵ is about 200 times weaker than that of H_α (for the He^+, H_2 process, the corresponding cross sections are 6×10^{-20} cm^2 and 1.4×10^{-17} cm^2). Various feasible reactions leading to the excitation of the lines investigated are discussed from the viewpoint of Massey's hypothesis. (auth)

26215 ON THE PHOTOIONIZATION ABSORPTION CROSS SECTION OF BERYLLIUM. I. A. Brytov and A. P. Lukirskii. Opt. Spectry. (USSR) (English Transl.), 16: 199 (Feb. 1964).

Experiments were performed to determine if the oxidation of beryllium films due to exposure to air was the cause for the discrepancy in previous determinations of the photoionization absorption cross section of beryllium. (C.E.S.)

26216 FAST ELECTRON BACKSCATTERING IN THE ENERGY REGION 8 TO 22 Mev. D. Harder and H. Ferbert (Universität, Würzburg, Ger.). Phys. Letters, 9: 233-4 (Apr. 15, 1964). (In German)

Measurements of the electron backscattering coefficients in the energy range 8 to 22 Mev were performed for aluminum, cadmium, copper, and lead. The experimental setup is described. Results are given for five energies and compared with results from two other experiments and from two Monte Carlo calculations. (M.J.T.)

26217 TOTAL IONIZATION IN ARGON BY HEAVY IONS OF ENERGIES 8 TO 100 kev. J. A. Phipps, J. W. Boring, and R. A. Lowry (Univ. of Virginia, Charlottesville). Phys. Rev., 135: A36-9(July 6, 1964). (TID-20171)

The total ionization produced by ions stopped in argon gas was measured in the energy range 8 to 100 kev. The experimental method employed an ion accelerator and a cylindrical ionization chamber with a differentially pumped open window. The following ions were studied: hydrogen, helium, carbon, nitrogen, oxygen, and argon. The average energy loss per ion pair (W value) was found to be dependent on both the velocity and mass of the incident ions at low ion velocities. The W value, in electron volts per ion pair, ranges from 26.8 for 50-kev protons to 90.9 for 25-kev argon ions. (auth)

26218 TWO-PHOTON IONIZATION OF ATOMIC HYDROGEN. Wolfgang Zernik (RCA Labs., Princeton, N. J.). Phys. Rev., 135: A51-7(July 6, 1964).

The general theory of two-photon ionization of a hydrogenic state in the nonrelativistic dipole approximation is discussed. An application is made to the photoionization of the metastable 2S state of atomic hydrogen by optical radiation, for example, by the light from a ruby laser. The sum over intermediate states is carried out exactly by means of an implicit technique. The results are given for a range of wavelengths from the threshold at 7290 down to 4556 Å. At 6943 Å, the total cross section per unit intensity is found to be 5.35×10^{-29} cm^4 W^{-1}. The lowest order damping corrections to the perturbation-theory results are worked out. (auth)

26219 BEHAVIOR OF THE He II 3s, p, d – 4s, p, d, f LINE COMPLEX IN A HOLLOW CATHODE PLASMA. Fred L. Roesler and J. E. Mack (Univ. of Wisconsin, Madison). Phys. Rev., 135: A58-71(July 6, 1964).

The fine structure of the He II 3s, p, d–4s, p, d, f line complex (σ = 21 335 K, λ = 4686 Å) as observed in a hollow cathode cooled in liquid helium was studied with a photoelectric double Fabry-Perot spectrometer. Among the component lines, (1) The relative intensities tend, with increasing pressure in the discharge region, toward the calculated statistical intensities, and with decreasing pressure, not toward Bethe's dynamical intensities but in each case toward a dynamical intensity determined by the lifetime and rate of excitation of the initial stage; (2) The measured relative positions are in good agreement with those calculated from quantum electrodynamics; small apparent discrepancies are believed to be associated with the excitation conditions; (3) The widths of the lines are appreciably greater than the widths of the He I lines at σ = 21 218 K, the derived widths being 74 and 44 mK, respectively; (4) The positions are significantly shifted (~4 mK) due to a drift of the He^+ ions toward the cathode, and there is evidence that the lines of the neutral atoms are shifted (~1 mK) due to a motion of the emitters toward the anode. (auth)

26220 PRIMARY IONIZATION COEFFICIENT MEASUREMENTS IN PENNING MIXTURES. Lorne M. Chanin and G. D. Rork (Honeywell Research Center, Hopkins, Minn.). Phys. Rev., 135: A71-5(July 6, 1964).

Measurements were made of the electron ionization coefficient η in helium-hydrogen and neon-hydrogen gas mixtures over an extended range of E/p_0 values. The present results show a variation of η with E/p_0 and hydrogen concentration similar to that previously obtained for neon-argon mixtures. The maximum values observed (0.0302 and 0.0285 V^{-1}) were obtained for hydrogen concentrations of 0.1% and at E/p_0 (V/cm × Torr) values of 15.0 and 3.0 for helium-hydrogen and neon-hydrogen mixtures, respectively. Results are compared with ionization measurements obtained using other techniques. (auth)

26221 MAGNETIC QUENCHING OF POSITRONIUM DECAY IN WATER. G. Fabri, G. Poletti, and G. Randone (Laboratori Centro Informazioni Studi Esperienze, Milan). Phys. Rev., 135: A80-2(July 6, 1964).

Experiments on magnetic quenching of positronium were carried out in water, and the results obtained by two different techniques are compared. The results did not agree with theoretical predictions, the starting assumption being that positronium annihilates by pick-off as a free atom. Some considerations are made about these anomalous features. (auth)

26222 ELECTRONIC STATES OF A KRONIG-PENNEY CRYSTAL WITH RANDOM ATOMIC POSITIONS. J. S. Faulkner (Oak Ridge National Lab., Tenn.). Phys. Rev., 135: A124-30(July 6, 1964).

The density of states for a one-dimensional system of r identical δ-function atoms randomly distributed on N lattice sites (lattice spacing d) is derived in the limit as r and N approach infinity by a nonperturbational method. The case

for which only one atom is allowed on a lattice site (F-D) and the case for which this restriction is dropped (B-E) are both treated. In the limit as r/N and d approach zero and if average number of atoms per unit length is kept fixed, a common limit for the density-of-states function is approached in the F-D and B-E cases. The limiting function is identical with the one found by Klauder using a Brueckner-like approximation. (auth)

26223 ATOMIC MULTIPOLE INTERACTIONS IN RARE-GAS CRYSTALS. R. S. Knox and M. H. Reilly (Univ. of Rochester, N. Y.). Phys. Rev., 135: A166-70(July 6, 1964).

It is demonstrated that one of the mechanisms proposed to explain the relative stability of rare-gas solids in the cubic form, namely greater repulsion between induced electrical multipoles in the hexagonal form, is completely ineffective. The present status of the stability problem is briefly discussed. (auth)

26224 TEMPERATURE AND THICKNESS DEPENDENCE OF TRANSITION RADIATION FROM THIN SILVER FOILS. E. T. Arakawa, N. O. Davis, and R. D. Birkhoff (Oak Ridge National Lab., Tenn.). Phys. Rev., 135: A224-6(July 6, 1964).

The transition radiation from vacuum evaporated silver foils bombarded by 25-, 40-, and 60-kev electrons was investigated as a function of foil thickness and temperature. The intensity at the wavelength of maximum emission was found to oscillate with foil thickness as predicted theoretically. The peak in the spectrum was observed to increase in intensity and also to be shifted to shorter wavelengths when the foil temperature was decreased. The observed shift in wavelength was much greater than the value predicted on the basis of a change in the electronic density alone, as would be the case for a pure plasma oscillation. The additional shift may be due to the change in the Fermi distribution of electrons which participate in the interband transition. The emission from silver thus appears to arise from a hybrid type of resonance, with the pure plasma resonance being shifted in energy by the interband transition. (auth)

26225 EXCITATION OF THE 2p STATE OF HYDROGEN BY ELECTRONS OF NEAR-THRESHOLD ENERGY. G. E. Chamberlain (Joint Inst. for Lab. Astrophysics, Boulder, Colo.), S. J. Smith, and D. W. O. Heddle. Phys. Rev. Letters, 12: 647-9(June 8, 1964).

The threshold region of the cross section for production of Lyman α photons (1216 Å) by electron bombardment of atomic hydrogen is studied. The wavelength under consideration is produced by the $2\underline{p} \rightarrow 1\underline{s}$ transition in atomic H. The electron energy range used is 11 to 30 ev. The cross section rises sharply to a maximum at 11.62 ev, drops slightly for about 0.3 ev, then rises gradually from about 12 to 30 ev. The cross section at 11.62 ev is about one-third that at 30 ev. The $2\underline{p} \rightarrow 1\underline{s}$ excitation function is unfolded from the experimental data by use of the experimental electron energy distribution. (T.F.H.)

26226 EVIDENCE FOR A NEW COLLECTIVE RESONANCE IN A "FREE-ELECTRON" METAL. M. H. Cohen and J. C. Phillips (Univ. of Chicago). Phys. Rev. Letters, 12: 662-4(June 15, 1964).

Structure observed in the optical absorption of K, including a resonance at 0.6 ev, is shown to be inexplicable within the conventional theory of metals and is attributed to a collective excitation. The most likely explanation for the resonance seems to be that the Landau framework fails for K. (D.C.W.)

26227 ASYMPTOTIC FORM OF THE ELECTRON CAPTURE CROSS SECTION IN FIRST BORN AND DISTORTED WAVE APPROXIMATIONS. R. A. Mapleton (Air Force Cambridge Research Labs., Bedford, Mass.). Proc. Phys. Soc. (London), 83: 895-905(June 1964).

The first Born approximation with both the proton-proton and proton-electron interactions is used to calculate the high energy electron capture cross section for the resonant process $H^+ + H(1s) \rightarrow H(1s) + H^+$. It is shown that the high energy proton-nucleus amplitude has a dominant peak for backward scattering (center-of-mass system). As a consequence of this peak, if the protons are treated as distinguishable particles, the cross section depends upon the impact energy E as E^{-3} in contrast to the commonly accepted E^{-6} dependence. When the protons are treated as indistinguishable particles, the electron capture cross section is not defined at sufficiently high energies. This same cross section is also calculated using the distorted wave approximation as developed by Bassel and Gerjuoy. It is shown that the proton-nucleus amplitude is cancelled only in the forward direction, and consequently the electron capture cross section is again not defined at high energies. These same approximations, together with the approximate helium wave function $Z^3/\pi \exp\{-Z(r_1 + r_2)\}$, (Z = 1.6875) are used to calculate the asymptotic form of the cross section for the process $H^+ + He(1s^2) \rightarrow H(1s) + (1s)$. It is shown that the distorted wave cross section is effectively the OBK cross section although the proton-nucleus amplitude is cancelled only in the forward direction as in the case of capture from atomic hydrogen. (auth)

26228 ASYMPTOTIC FORM OF THE IMPULSE APPROXIMATION ELECTRON CAPTURE CROSS SECTION: EXACT RESONANCE. J. Coleman and M. R. C. McDowell (London Univ.). Proc. Phys. Soc. (London), 83: 907-10 (June 1964).

It is shown that the asymptotic form of the impulse approximation to the cross section for the exact resonance electron-capture process $H^+ + H(1s) \rightarrow H(1s) + H^+$ is identical with that of the first Born approximation. That is, it behaves as $\frac{1}{12}(m/M)^2E^{-6}\pi a_0^2$ as $E \rightarrow \infty$ (in units of 100 kev) for distinguishable protons and is undefined for indistinguishable protons. (auth)

26229 ELECTRON CAPTURE BY MULTIPLY CHARGED IONS. J. B. Hasted and M. Hussain (London Univ.). Proc. Phys. Soc. (London), 83: 911-24(June 1964).

Double mass-spectrometer measurements are reported of one- and two-electron-capture cross sections for Ne^{2+} Ne, Ar^{2+} Ar, Kr^{2+} Kr, Xe^{2+} Xe, CO^{2+} N_2, and Kr^{4+} Ne in the energy region 400–3600 ev. The symmetrical resonance two-electron processes are compared with the theory of Fetisov and Firsov. The single-electron transitions are believed to occur at pseudo-crossings of potential energy curves and the data are successfully interpreted in terms of transitions at single crossings. Inferences are made of the second ionization potentials of CO and N_2, and of the fourth ionization potential of Kr. (auth)

26230 ON THE $Z^{-1/2}$ EXPANSION OF UNRESTRICTED HARTREE-FOCK WAVE FUNCTIONS. A. L. Stewart (Stanford Research Inst., Menlo Park, Calif.). Proc. Phys. Soc. (London), 83: 1033-7(June 1964).

It is pointed out that the perturbation expansions of unrestricted Hartree-Fock orbitals based on zero-order uncorrelated orbitals contain terms of order $Z^{-1/2}$ which do not appear in the similar expansions of conventional Hartree-Fock orbitals. It is shown that these terms give

about 90% of the total radial correlation in the second-order energy of the ^1S ground state of the two-electron systems. (auth)

26231 THE FINE STRUCTURE OF THE ^3P TERMS OF THE LITHIUM ISOELECTRONIC SEQUENCE. K. L. Bell and A. L. Stewart (Queen's Univ., Belfast). Proc. Phys. Soc. (London), 83: 1039-43(June 1964).

Calculations of the fine structure separation of the $1s^2np\ ^3P$, n = 2, 3, and 4, states of the three-electron systems are made using wave functions of the open-shell type. Satisfactory agreement with experiment is obtained only in the case of the highly ionized systems. (auth)

26232 TABLE OF ENERGY vs. MAGNETIC RIGIDITY FOR SINGLY IONIZED ^{3}He PARTICLES. J. A. Careaga. Rev. Mex. Fis., 12: 161-202(1963). (In Spanish)

A table of singly ionized ^{3}He nuclei energies vs magnetic field strength times orbit radius was prepared in the range 50 to 2000 Kgauss · cm. (auth)

26233 INVESTIGATION OF THE SECONDARY EMISSION OF EXCITED CESIUM ATOMS ON THE BOMBARDMENT OF MOLYBDENUM WITH POSITIVE CESIUM IONS. V. I. Veksler (Tashkent State Univ.). Soviet Phys-Solid State (English Transl.), 5: 2003-9(Apr. 1964). (Translated from Fiz. Tverd. Tela, 5: 2737-46(Oct. 1963).

A method for the experimental investigation of the secondary emission of excited atoms produced during the fast ion bombardment of a solid having a low probability of transition to the ground state is described. The method makes it possible to obtain the angular distributions of the numbers of the excited atoms $n(\varphi)$ and their average energies $\bar{\varepsilon}(\varphi)$. Maxima, corresponding to reflection angles of ~30°, were found in the experimentally determined functions $n(\varphi)$ and $\bar{\varepsilon}(\varphi)$ for the bombardment of molybdenum with Cs^+ ions of energies U = 560−2500 ev and incident at 60°. It was found that, on increase of U, the average energy of the excited atoms increases slightly but the secondary-emission coefficient rises considerably. The results obtained may be interpreted as the result of the sputtering of a surface layer of cesium atoms sorbed from the primary beam. A qualitative mechanism for the phenomenon is suggested. The ion flash method was used to control the equilibrium surface coverage with cesium atoms (θ = 0.06 − 0.08), which was found to be weakly dependent on the primary-ion energy. (auth)

26234 HARTREE-FOCK-SLATER SCATTERING FACTORS FOR NEUTRAL ATOMS. James Dighton Lea. Thesis, Austin, Tex., Univ. of Texas, 1963. 314p.

Atomic scattering factors have been calculated for all neutral atoms from atomic number 2 to atomic number 103 by use of Hartree-Fock-Slater nonrelativistic wave functions. These scattering factors are tabulated for values of the parameter s as follows: $0 \leq s \leq 60.0$, $\Delta s = 0.5$, and for values of the parameter $1/\lambda \sin\theta$ as follows: $0 \leq 1/\lambda \sin\theta \leq 6.0$, $\Delta\,[1/\lambda \sin\theta] = 0.05$, where the dimensions of both parameters are $(A)^{-1}$. A brief outline of the theory underlying the Hartree-Fock-Slater approximation is given. Comparison of Hartree, Hartree-Fock and Hartree-Fock-Slater wave functions for oxygen indicates that the Hartree-Fock-Slater charge density is greater near the nucleus of an atom than resulting from the other two methods of solution. The scattering factors presented are compared with experimental values obtained from electron diffraction studies as well as with other theoretical values. For an atom for which Hartree-Fock solutions exist the comparison with experimental values shows essentially no difference between Hartree-Fock and Hartree-Fock-Slater factors. For an atom in the range of medium Z, however, where the only other theoretical values available are those given by the Thomas-Fermi-Dirac theory, the Hartree-Fock-Slater values lie noticeably closer to experimental values. (Dissertation Abstr.)

26235 CHARGE TRANSFER CROSS SECTIONS FOR LYMAN ALPHA EMISSION FROM PROTON COLLISIONS WITH THE RARE GASES. Donavon Donald Pretzer. Thesis, Seattle, Univ. of Washington, 1963. 85p.

Non-resonant charge transfer cross sections for Lyman alpha emission from proton collisions with the rare gases have been measured in the energy range 1 to 25 kev with maxima that vary from 3×10^{-18} cm^2 for helium to 9×10^{-17} cm^2 for xenon. The radiation observed can arise only from transitions involving the 2P state of the hydrogen atom. The 2S state is known to be metastable, decaying directly to the 1S ground state by emitting two photons simultaneously. This transition has a mean lifetime of $^1/_8$ sec as compared to 10^{-9} sec for the optically allowed transition from the 2P to the 1S state. The apparatus does not detect the long-lived 2S state, but any excitation involving the 2P state with subsequent emission of a photon at 1215.7 A would be detected. The detector is a helium-iodine photon counter used in conjunction with an O_2 gas filter. Non-resonant charge transfer cross sections for protons on the rare gases have been measured by several earlier experimenters, and without exception these cross sections, when plotted versus energy of the incident proton, exhibit a single rather broad maximum. In contrast to this, the cross sections presented for the reactions $H^+ + Ne$, $H^+ + A$, and $H^+ + Kr$ show two distinct maxima. The cross section for $H^+ + He$ has a shoulder on the high energy side of the maximum, indicating that another mechanism is interfering with the normal rate of decrease of this maximum. The cross section for $H^+ + Xe$ shows a distinct peak at 10 kev, and there is a possibility of another peak below the low energy limit of the apparatus. All curves are the average of two or more independent runs. The points are reproducible to within ± 5% and the absolute values are ±45%. No correction has been made for polarization effects. The interesting aspects of this data are compared with current theories for non-resonant charge transfer and the work of other experimenters. Possible mechanisms for the double peaks are discussed. (Dissertation Abstr.)

26236 TABLES OF ASYMMETRY, CROSS-SECTION, AND RELATED FUNCTIONS FOR MOTT SCATTERING OF ELECTRONS BY SCREENED GOLD AND MERCURY NUCLEI. G. Holzwarth and H. J. Meister. Munich, Universitat, 1964. 119p.

Calculations were made by the Mott formula for Z = 79, 80, and (in two cases) 81 using a relativistic Hartree potential. The functions are tabulated for all scattering angles at one degree intervals for twenty-six energies between 0.2 and 290 kev. Some functions are also plotted. (D.C.W.)

26237 ANGULAR DEPENDENCE OF THE SCATTERING OF METASTABLE HELIUM ATOMS IN HELIUM AND NEON. Hubert Lyle Richards. Thesis, Gainesville, Fla., Univ. of Florida, 1963. 87p.

A molecular beam method has been used to perform scattering experiments with an atomic beam of metastable helium atoms in helium and neon. The atomic beam, in which some of the atoms had been excited to metastable levels by electron impact, was passed through the scattering chamber at pressures of the order of 10^{-3} mm of Hg. The metastable atoms were detected by electron ejection from gold surfaces. The ratio of the product of the in-

tensity of the singlet metastable helium and its ejection efficiency to the triplet intensity and its ejection efficiency, $\gamma_1 I_{01}/\gamma_3 I_{03}$, has been determined both as a function of electron energy and source pressure. An increase in this ratio was observed with increasing source pressure and was attributed primarily to imprisonment of resonance radiation. A total collision cross section which is the sum of the elastic and inelastic cross sections has been measured for metastable helium in helium and neon as a function of angular resolution of the molecular beam apparatus. An increase in the cross sections was observed as the angular resolution was increased. In both cases the cross section for the 2^3S state of helium was larger than that for 2^1S state; however, the difference between triplet and singlet cross sections in neon was larger than in helium. In both cases, this became larger with increasing resolution. The differences in the cross sections can only be caused by differences in the interaction forces between the colliding particles. (Dissertation Abstr.)

26238 EFFECTS OF IMPURITIES ON THE HALF-LIFE OF THE METASTABLE STATES OF THE HELIUM ATOM. Edward Everett Benton, Jr. Thesis, Austin, Tex., Univ. of Texas, 1962. 101p.

An investigation was conducted to study the effects of impurity atoms or molecules on the lifetime of the metastable states of the helium atom. The time sampling technique of Phelps and Pack was chosen as the method for studying the population of the metastable states. The change in the destruction frequency of the metastable state due to the addition of a known amount of impurity is related to the de-excitation cross section by $\sigma = \nu_i/n_i\overline{V}_r$. Here ν_i is the change in destruction frequency, n_i is the density of the impurity atoms (or molecules), and $\overline{V}_r$ is the average relative velocity of the two colliding particles. For the case of a Penning gas (one whose ionization potential is less than that of the metastable atom) the impurity is ionized $He^M + Ar \rightarrow He + Ar^+ + e$ (Kinetic Energy). Neon is not a Penning gas and can only be excited: $He^M + Ne \rightarrow He + Ne^* \rightarrow He + Ne + h\nu$. The most consistent data taken were the cross sections for de-excitation of 2^3S helium metastables by Ar, Kr, Xe, N_2, H_2, and Ne atoms (or molecules) and de-excitations of 2^1S metastables by Ne. The data and over-all accuracies are: Argon (2^3S) -6.6×10^{-16} cm^2 (±20%); Krypton (2^3S) -1.03×10^{-15} cm^2 (±20%); Xenon (2^3S) -1.39×10^{-15} cm^2 (±20%); Nitrogen (2^3S) -6.4×10^{-16} cm^2 (±50%); Hydrogen (2^3s) -6.0×10^{-16} cm^2 (±35%); Neon (2^3S) -2.8×10^{-17} cm^2 (±20%); Neon (2^1S) -4.1×10^{-16} cm^2 (±20%). The accuracy of Ar, Kr, Xe, and Ne is mostly limited by the uncertainty of n_i. For N_2 and H_2 there was an additional difficulty in that these active gases "cleaned up" rapidly during the pulsed discharge. The "clean up" of O_2 and CO_2 was found to be too fast for even an order of magnitude measurement. On the basis of the measurements for Ar, Kr, and Xe it was concluded that the de-excitation cross section most likely did not depend on the ionization potential of the impurity but rather was a linear function of the collision cross section (from viscosity or scattering data). The measurement of cross section for de-excitation of 2^1S metastables by Ar, Kr, and Xe were nearly an order of magnitude greater than for the 2^3S metastables. The best explanation was that a larger number of electrons are left after the discharge pulse due to the presence of the impurity. This causes an increase in the rate of destruction by the process: $He^M (2^1S) + e \rightarrow He^M (2^3S) + e$ (0.79 ev). In order to obtain any conclusive data, it would be necessary to measure electron density concurrently with metastable population. (Dissertation Abstr.)

26239 THE PHOTOIONIZATION CROSS SECTION OF NEON FROM 80A TO 600A. David Lothar Ederer. Thesis, Ithaca, N. Y., Cornell Univ., 1963. 100p.

The photoelectric cross section of neon has been measured from the threshold at 575A, corresponding to the $L_{2,3}$ edge, to 80A. The absorbing gas was confined to a cell located within either a grazing or a normal incidence spectrometer depending on the spectral region involved. The cell was irradiated by the lines from a Penning or capillary discharge and by the soft x-ray emission bands of aluminum and iron. Below 310A intensity comparisons were carried out by the use of a Geiger-Mueller counter as well as by photographic techniques. Above 310A photographic detection was used exclusively. Over the region of over-lap good agreement was found between the two detectors. At the onset of absorption, which occurs at a wavelength of 575A, the cross section was 6.3 Mb. It then rises smoothly to a maximum of 10.0 Mb at 375A, then drops to 7.4 Mb at 266A at the L_1 edge. The jump at the edge is about 1.0 ± 0.6 Mb. Beyond the L_1 edge up to wavelengths of 80A the cross section is very nearly proportional to the wavelength. At 80A it has the value of 2.50 Mb. The present results are compared with previous measurements and with recent theoretical calculations. For the first time it was possible to evaluate several oscillator strength sum rules. The values obtained from the oscillator strength sum rules were in excellent agreement with other independent measurements. (Dissertation Abstr.)

26240 SOME APPLICATIONS OF THE THOMAS-FERMI ATOM WITH HYDRODYNAMIC OSCILLATION. Joseph Andrew Ball. Thesis, Princeton, N. J., Princeton Univ., 1963. 131p.

The Bloch semi-classical model of hydrodynamic oscillation in the Thomas-Fermi atom is used to calculate atomic properties. This model furnishes results which scale in a simple way with Z and are universally applicable to all heavy atoms. The equations of the normal modes of hydrodynamic oscillation are integrated numerically. Solutions are obtained in a range of oscillation frequency extending over two orders of magnitude, both for the spherically symmetric mode of oscillation and the dipole mode of oscillation. Using the numerical solutions for the dipole mode, the universal photo-absorption cross section of Wheeler and Fireman is re-calculated and extended in frequency. In the far ultraviolet and soft x-ray region the cross section predicted by the hydrodynamic model agrees with experimental cross sections as well as could be expected for any universal cross section, applicable to all atoms. Evaluation of the logarithmic mean excitation energy using the calculated cross section yields (5.06) Z ev, a value which does not agree with the experimental value of the 10 to 13 times Z ev. The numerical solutions for the symmetric mode are used to calculate the total average energy of atomic excitation when in β decay the nuclear charge changes suddenly by one unit. The result, $E = (31.7 \pm 0.2)\ Z^{1/3}$ ev, agrees with previous theoretical estimates. By a correspondence principle argument the probability distribution of the atomic excitation energy for a sudden change of nuclear charge is deduced from the hydrodynamic analysis. The features of this distribution agree with existing theoretical and experimental evidence. The atomic excitation resulting from the nuclear recoil is described with the hydrodynamic model. In this process the distribution of excitation energy over frequency is found to be proportional to the universal photo-absorption cross section calculated earlier. (Dissertation Abstr.)

26241 NUCLEAR ENERGY. L. A. Redman. New York and London, Oxford University Press, 1963. 110p. $2.40; 15s.

Information is included on: discovery of the atom; discovery of the electron; x rays and radioactivity; energy from atoms; controlling nuclear energy; dangers of nuclear radiations; handling hot chemicals; getting the uranium; using nuclear power; making radioactive isotopes; radioactivity in everyday life; radioactivity in research; and making a miniature sun. Important dates in nuclear energy are appended. (P.C.H.)

Cosmic Radiation

26242 MODIFICATION OF THE METHOD OF THE ADELPHIC INTEGRAL AND ITS APPLICATION TO THE PROBLEM OF STOERMER. O. Godart (Université, Louvain, Belg.). Ann. Soc. Sci. Bruxelles. Ser. I, 78: 45-68 (Apr. 2, 1964). (In French)

To precisely determine the position of the guiding center is equivalent to computing the trajectories. However, for a dipole field, an approximation for the trajectories of particles with high momentum with respect to the axis of symmetry yields centers of curvature which are nearly a unique magnetic line force. If this curve is used as the axis of reference, a more exact solution can be calculated by classical mechanics methods similar to the adelphic integral of Whittaker. The shortcomings of this method are examined, and an improvement based on the determination of a complete integral of the Hamilton–Jacobi equation is proposed. In most cases, a special choice of variables permits the hamiltonian to be written as a polynomial of two of the canonical variables and a periodic function of the two others. A converging implicit solution can then be determined. (auth)

26243 TWENTY-SEVEN-DAY RECURRENCE OF SOLAR PROTONS. J. B. Gregory and R. E. Newdick (Univ. of Canterbury, Christchurch, N. Z.). J. Geophys. Res., 69: 2383-5(June 1, 1964).

Experimental observations are cited which show that solar proton fluxes tend to recur at intervals of about 27 days after the original solar proton event. The solar proton fluxes appear to recur at the earth after one, two, and possibly more solar rotations. (D.C.W.)

26244 ANOMALOUS ENERGY SPECTRUM OF PROTONS IN THE EARTH'S RADIATION BELT. R. Walker Fillius (Univ. of Iowa, Iowa City) and Carl E. McIlwain. Phys. Rev. Letters, 12: 609-12(June 1, 1964).

The spatial distribution and energy spectrum of trapped protons were measured over a broad region of space from 2500 to 7500 km in altitude, during Dec. 1962 to Sept. 1963, using the satellite Relay I. An energy range from 1 to 110 Mev is considered. (M.J.T.)

26245 COSMIC RADIATION PHYSICS. G. B. Zhdanov (Lebedev Inst. of Physics, Moscow). Priroda, No. 2, 82-7 (Feb. 1964). (In Russian)

A review is given on the data discussed at the All-Union Conference on Cosmic Radiation, Moscow, Oct. 4–6, 1963. New instruments and method for studying cosmic particle interactions with atoms, particle generation, and cosmophysics, are discussed. (R.V.J.)

26246 THE MORPHOLOGY OF THE ELECTRON DISTRIBUTION IN THE OUTER RADIATION ZONE AND NEAR THE MAGNETOSPHERIC BOUNDARY AS OBSERVED BY EXPLORER XII. John Wright Freeman, Jr. Thesis, Iowa City, Iowa, Iowa State Univ., 1963. 124p.

The elliptic orbit satellite Explorer XII made possible the routine survey of the heart of the outer radiation zone as well as the region of transition between the magnetosphere and interplanetary space on the sunward side of the earth using a variety of particle and magnetic field detectors. A comprehensive analysis of the data received from the S.U.I. detectors during the entire 112 day lifetime has been performed. Salient features observed include: confirmation of the enhancement of soft electron fluxes and diminution of hard electron fluxes in the outer zone during magnetically disturbed times; the outward motion of the outer zone hard electron maximum during periods of enhancement; confirmation of the general Chapman and Ferraro picture of a well defined magnetosphere with compression of the geomagnetic field during the initial phases of magnetic storms; the existence of a layer of quasi-thermalized plasma immediately outside the magnetosphere; confirmation of the result of Frank and Van Allen that the contours of constant counting rate for $E \geq 40$ kev electrons tend to protrude outward near 90° from the subsolar point and draw closer to the earth on the night side; and general support for the result of Gringauz, Kurt, Moroz, and Shklovskii, that there exists a region beyond some 8 R_e on the night side of the earth dominated by very low energy electrons. (Dissertation Abstr.)

26247 DETECTION OF SOLAR PARTICLE STREAMS USING HIGH-FREQUENCY RADIO WAVES. Bruce Burr Lusignan. Thesis, Stanford, Calif., Stanford Univ., 1963. 39p.

Interactions between radiowaves and charged particles change their character when the particles have high average velocities. The nature of such interactions is investigated assuming no collisions, no external magnetic field, and low particle densities. A stream of such particles makes the medium anisotropic. As a result the medium propagates two waves of unchanging (characteristic) polarization, one linearly polarized perpendicular to the particle stream and a second at right angles to the first. Such a medium can change the polarization ellipse of a propagating wave. The sun produces such streams radiating outward, either in the form of a steady "solar wind" or in bursts associated with sun spots. Three experiments are suggested to detect the streams by measuring polarization of waves propagated through them. The least sensitive of the three, moon radar, would have measurable effects only during increased solar activity, while the other two—transmission to a deep space probe and observation of polarized cosmic noise sources—show effects even during quiet solar conditions. These sensitivities are based on observations of the proton component of the solar wind. (Dissertation Abstr., 34: No. 8(Feb. 1964))

Criticality Studies

26248 STUDY OF CRITICAL ASSEMBLIES WITH BERYLLIUM MODERATOR. N. N. Ponomarev-Stepnoĭ and S. S. Lomakin. At. Energ. (USSR), 16: 228-33(Mar. 1964). (In Russian)

Be-containing systems must be further investigated because the currently available data do not agree with the theoretical calculations. The relationship between the neutrons originating from the Be(n,2n) reaction and from fission was examined by means of U–Be critical assemblies, built from 100 × 50 × 10 mm thick Be plates with a density of 1.8 g/cm^3 and 100 × 100 × 0.5 mm fuel plates, consisting of U_3O_8 with a ^{235}U content of 1.34 g per element, and fluorothene. The slowing-down length was determined up

to energy levels at which the transition to the thermal neutron spectrum and the fast neutron multiplication factor must be taken into account because of the fission and the Be(n,2n) reaction. The multigroup system of the neutron-physical constants used in the calculations yielded satisfactory results. The experimentally obtained value of $\tau = 90.1$ cm^2, including the thermalization range from 1.44 to 0.2 ev, allowed the slowing-down process of neutrons in the Be to be defined more exactly. A value of $\gamma = 1.12$ was obtained, assuming the threshold value of the Be(n,2n) reaction is 1.85 Mev. The effect of this reaction must be taken into consideration when calculating for a Be-containing system. (TTT)

26249 METHODS FOR THE DETERMINATION OF $_{28}\rho$ AND δ^{28} BASED ON CHEMICAL SEPARATION OF Np^{239} AND Mo^{99} FROM URANIUM AND FISSION PRODUCTS. S.O. Larvin (Nuclear Research Center "Democritus," Athens). p.161-79 of "Exponential and Critical Experiments. Vol. II." Vienna, International Atomic Energy Agency, 1964.

Methods are presented for the measurement of ρ^{28} and δ^{28}. The methods for ρ^{28}, the ratio of epicadmium to subcadmium capture of neutrons in ^{238}U, is based on the chemical separation of neptunium from uranium and fission products in two fuel samples, one irradiated in the lattice under study and one in a pure thermal neutron flux. The irradiations are normalized by means of auxiliary dysprosium foils. A description of the separation procedure and measuring technique is presented together with some experimental values found for D_2O-moderated lattices studied in the NORA zero-power reactor. The method for δ^{28}, the ratio of the fission rate in ^{238}U to that in ^{235}U, is based on the chemical separation of ^{99}Mo from uranium foils of different enrichment, irradiated in the lattice under investigation. A description of the irradiation and separation procedure is presented together with experimental results obtained in D_2O-moderated lattices studied in JEEPNIK, a miniature exponential facility. (auth)

Direct Energy Conversion

Refer also to abstracts 26771, 26824, and 26933.

26250 (AD-423086) THEORY FOR PLASMA-FILLED DIODES. Charles Cason (Army Missile Command, Redstone Arsenal, Ala.). Oct. 15, 1963. 14p. (RR-TR-63-22; N64-12666)

A theoretical analysis of thermoelectric properties of thermionic converters is made according to a Langmuir probe analogy beginning with Kirchhoff's current law. An expression is developed for the load voltage in terms of external circuit current, thermionic electrode characteristics, and plasma properties. Very good agreement between predicted diode properties and observations is shown at low pressure. (auth)

26251 (AD-437280) HIGH-TEMPERATURE THERMOELECTRIC RESEARCH. Quarterly Progress Report No. 2, December 31, 1963–April 3, 1964. C. M. Henderson (Monsanto Research Corp. Dayton Labs., Ohio). Contract AF33(615)-1084. 54p.

Research is carried out to establish the technical feasibility of utilizing high temperature thermoelectric generators, powered with nuclear and solar heat sources, as long-lived power supplies for aerospace vehicles. A nominal 50-watt laboratory generator, previously damaged by heating its intermediate junction between thermoelectric segments beyond 950°C, was repaired and subjected to renewed sustained testing at a hot-junction temperature of about 1200°C in a vacuum of 10^{-5} to 10^{-6} torr. It completed 360-hr continuous testing at 1200°C without apparent degradation of its power generating characteristics, and the test is continuing. An improved experimental model generator was designed, fabricated, and subjected to shakedown tests, prior to the start of sustained tests on the unit. Improved methods to permit monitoring of critical intermediate junction temperatures in multi-segment thermoelements were developed and progress was made in the development of arc-plasma spray techniques for producing thermoelements and in investigations to explain the mechanisms responsible for the performances of the high-temperature thermoelectric materials used. (auth)

26252 (BSD-TDR-64-35) SEGMENTED ELECTRODE LOSSES IN MHD GENERATORS WITH NONEQUILIBRIUM IONIZATION. Research Report No. 178. Jack L. Kerrebrock (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Apr. 1964. Contract AF04(694)-414. 27p. (AD-437129)

A theory is proposed that accounts for the effect of Joule dissipation near a segmented electrode wall on the electrical conductivity near the wall. In MHD generators, which are designed to produce nonequilibrium ionization due to electron heating, the elevation of conductivity will occur first near the electrode wall, because the Joule heating of the fluid is much greater there than in the free stream. This local increase of conductivity will tend to cause a flow of current in the Hall direction that amplifies the dissipation and greatly reduces the current density and elevation of electron temperature that can be attained in the generator. A theory is proposed that accounts for these phenomena in predicting generator performance as a function of the usual variables, plus the ideal electron temperature rise. The predicted maximum Hall potentials agree qualitatively with those measured by Klepeis and Rosa in a $\frac{1}{2} \times 3$-inch generator channel. (auth)

26253 (GA-4677) RESEARCH ON CESIUM-VAPOR CELLS EMPLOYING CARBIDE EMITTERS. Final Technical Report, May 1, 1960–October 31, 1963. (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Dec. 27, 1963. Contract Nonr-3193(00). 35p. (AD-426960)

Measurements were performed on experimental thermionic cesium cells as direct converters of heat to electricity. Results indicate that cesium is adsorbed on the surfaces of carbide emitters, and that useful power is produced in a cell that contains a carbide emitter and carbide collector. Operational characteristics of identical thermionic cells, which contained a tungsten emitter and carbide emitter, are illustrated. (auth)

26254 A PROCEDURE FOR CONVERSION INTO ELECTRICITY OF THE IONIZING ENERGY RELEASED BY A NUCLEAR REACTOR. Siegfried Klein (Laboratoire de Spectroscopie Hertzienne, Faculte des Sciences, Besancon, France). Compt. Rend., 258: 2767-73(Mar. 9, 1964). (In French)

A new experiment performed in a EL-3 Reactor channel for the production of continuous electrical current from an ionized vapor is described. The preponderant ionizing agent is the fission products from a thin layer of enriched uranium dioxide. A considerable electromotive force was detected. The electrical current measured was proportional to the reactor power. (tr-auth)

26255 DIRECT ENERGY CONVERSION. Mostafa E. Talaat. Ind. Res., 6: No. 5, 67-75(May 1964).

The four most important means of direct energy conver-

sion—magnetoplasmadynamic, thermionic, and thermoelectric generators, and the fuel cell—are reviewed. Power range, operating temperature, lifetime, efficiency, size, and stage of existence—experimental or working model—are discussed for each. (M.J.T.)

26256 THERMIONIC CATHODES AND MAGNETRON EFFECT. J. Bliaux, J. P. Durand, and R. Merard. Onde Elec., 43: 763-73(July-Aug. 1963).

Study of plasma-type thermionic diodes for direct conversion of nuclear energy to electricity enables their use to be conceived in the near future, particularly in space work. The overall thermodynamic efficiency of these converters is limited, among other things, by the B magnetic induction associated to the cathode count: the electron paths are curved and a fraction $J_0 - J$ of the current J_0 emitted per unit area returns to the emissive cathode and one may therefore then talk to the electric output $\rho[\rho = (J/J_0)]$ caused by this parasitic "magnetron" effect. The electric output was studied theoretically as a function of the geometric shape of the cathodes, assuming a simple relation between the output ρ and the associated induction B. (Sum. Articles French Tech. Press, No. 6, 1963)

26257 MAGNETOPLASMADYNAMIC ELECTRICAL POWER GENERATION. Report of a Symposium held at King's College, University of Durham, Newcastle upon Tyne, 6-8th September 1962. I.E.E. Conference Report Series No. 4. London, The Institution of Electrical Engineers, 1963. 170p. £10 10s.

Forty-two papers are included; a separate abstract was prepared for one paper not previously abstracted in NSA. Abstracts of other papers appeared as 17: 9071 through 9098 and 17: 9791 through 9803. (D.C.W.)

For abstract of individual paper see: 26258.

26258 M.P.D. POWER GENERATION STUDIES AT AB ATOMENERGI. J. Braun (AB Atomenergi, Studsvik, Tystberga, Sweden). p.4-6 of "Magnetoplasmadynamic Electrical Power Generation." London, The Institution of Electrical Engineers, 1963.

The efficiencies of some gas and steam cycles for nuclear MHD generation were calculated. The internal MHD efficiency for the Hall generator was also obtained. (D.C.W.)

26259 MATERIALS FOR NUCLEAR THERMIONIC CONVERTERS. J. Adam (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.81-92 of "Advances in Materials. Inter-Disciplinary Symposium, First and Second Sessions, 6 April, 1964." London, The Institution of Chemical Engineers, 1964.

Successful development of nuclear thermionic converters hinges heavily on the development of materials capable of withstanding rather difficult working conditions for long periods of time. Description is given of fabrication, testing and properties of fuel for a thermionic converter which operated in reactor with a surface temperature of 2000°C. Post-irradiation examination revealed that evaporation had taken place at the surface of the fuel and that the chemical composition of the evaporated material differed from that of the original fuel. Fuels canned in refractory metals are considered. Cesium vapor which is needed in the converter for space charge neutralization introduces many compatibility problems. The most serious of these is the problem of a ceramic to metal seal. Experiments show that low grade alumina frequently used in seals is heavily attacked by cesium and some of the most commonly used brazes fail in cesium atmosphere. Seals adequate for comparatively short term experiments are now available, but the development of cesium resistant seals suitable for operation at temperatures in excess of 1000°C is necessary for future practical thermionic converters. (auth)

Elementary Particles and Radiations

Refer also to abstracts 26407 and 26415.

26260 (BNL-837) INTERNATIONAL CONFERENCE ON FUNDAMENTAL ASPECTS OF WEAK INTERACTIONS, HELD AT BROOKHAVEN NATIONAL LABORATORY, SEPTEMBER 9-11, 1963. (Brookhaven National Lab., Upton, N. Y.). Contract AT-30-2-GEN-16. 466p.

Thirty-two papers are included. Separate abstracts were prepared for 23. Nine papers were previously abstracted in NSA; see abstracts 17: 23664, 39847; 18: 2684, 4429, 4610, 7465, 7466, 21160, 24402. (M.J.T.)

For abstracts of individual papers see: 26165, 26166, 26187, 26261, 26262, 26263, 26264, 26265, 26266, 26267, 26268, 26269, 26270, 26271, 26272, 26273, 26274, 26275, 26523, 26524, 26525, 26526, and 26527.

26261 (BNL-837(p.42-52)) A MEASUREMENT OF THE LIFETIME OF K_2^0 MESONS. J. V. Jovanovic, J. Fischer, T. Fujii, F. Turkot (Brookhaven National Lab., Upton, N. Y.); R. W. Burris, D. S. Loebbaka, and G. T. Zorn (Maryland. Univ., College Park).

The lifetime of the K_2^0 meson was measured by comparing the K_2^0 rates at two positions along a neutral beam. A preliminary value of $(5.83 \pm 0.80) \times 10^{-8}$ sec was obtained. (M.J.T.)

26262 (BNL-837(p.54-65)) POSSIBLE VIOLATION OF $\Delta S = \Delta Q$. C. Y. Chang (Columbia Univ., New York); H. Brugger (Rutgers Univ., New Brunswick, N. J.); and D. Berley (Brookhaven National Lab., Upton, N. Y.).

Experiments were conducted to check previous results which would require the existence of $\Delta S = -\Delta Q$ currents. Observations on the time distribution of electronic ^8K decay are consistent with no $\Delta S = \Delta Q$ violation, thus contradicting earlier results. For experiments on the decay $\Sigma^+ \rightarrow \mu^+ + \bar{\nu} + n$, there is some inconclusive evidence that $\Delta S = \Delta Q$ is violated. In addition, the rate for the radiative decay $\Sigma^+ \rightarrow \pi^+ + n + \gamma$ was measured. (M.J.T.)

26263 (BNL-837(p.74-81)) $K_1 - K_2$ MASS DIFFERENCE. J. H. Christenson, J. W. Cronin, V. L. Fitch, and R. Turlay (Princeton Univ., N. J. Palmer Physical Lab.).

The $K_1 - K_2$ mass difference was measured. The method used is based on the fact that the intensity of the K_1 wave resulting from the addition of the amplitudes from two pieces of material used for coherent regeneration of K_1 mesons is a highly sensitive function of the gap between the pieces and the mass difference. A plot of relative likelihood as a function of mass difference is given. (M.J.T.)

26264 (BNL-837(p.82-7)) K_2^0 REGENERATION IN HYDROGEN. F. R. Eisler, T. C. Bacon, and H. W. K. Hopkins (Brookhaven National Lab., Upton, N. Y.).

The observation of K_2^0 decay and K_1^0 regeneration in a liquid hydrogen bubble chamber is reported. The magnitude of K_1^0 regeneration is consistent with that predicted from the theory for a $K_1^0 - K_2^0$ mass difference of about $\hbar/\tau_1$. (M.J.T.)

26265 (BNL-837(p.114-36)) PRELIMINARY RESULTS FROM THE HEAVY LIQUID BUBBLE CHAMBER IN THE CERN NEUTRINO EXPERIMENT. R. G. P. Voss (European Organization for Nuclear Research, Geneva).

About 240 events, out of 461,000 expansions photographed, were found in rapid scanning. The background events, due to cosmic rays and leakage neutrons, are described. Neutrino events are classified and discussed; energy distributions and some typical photographs of events are presented. (M.J.T.)

26266 (BNL-837(p.160-9)) CERN NEUTRINO EXPERIMENT. M. Veltman (European Organization for Nuclear Research, Geneva).

Preliminary conclusions are reported for the neutrino-flip and 2-neutrino hypothesis, lepton conservation, elastic and inelastic processes, heavy muon production, electromagnetic properties of the neutrino, neutral currents, and W-production. (M.J.T.)

26267 (BNL-837(p.237-48)) A FIELD THEORY OF WEAK INTERACTIONS. G. Feinberg (Columbia Univ., New York).

A previously-developed method in the theory for interactions of charged vector mesons with leptons is briefly described. Alternative treatments of the leptonic ladder graphs are discussed. Applications of the theory to the four-fermion interaction, to semileptonic baryon-lepton scattering, semileptonic meson-lepton scattering, and to nonleptonic meson-meson scattering are considered. (M.J.T.)

26268 (BNL-837(p.249-56)) SOME THEORETICAL CONSIDERATIONS CONCERNING THE NEUTRINO EXPERIMENTS. C. N. Yang (Institute for Advanced Study, Princeton, N. J.).

The possible production of $W^{\pm}$ and the form factors for the elastic processes $\nu + n \rightarrow p + \mu^-$ and $\bar{\nu} + p \rightarrow n + \mu^+$ are discussed with reference to their potential elucidation in the CERN neutrino experiment. (M.J.T.)

26269 (BNL-837(p.257-65)) HIGHER ORDER LEPTONIC WEAK INTERACTIONS. Tai Tsun Wu (Harvard Univ., Cambridge, Mass. and Institute for Advanced Study, Princeton, N. J.).

A possible effect of higher order weak interactions on the reaction $\nu_\mu + Z \rightarrow \mu + W + Z$ is discussed. The μ decay is considered. A dimensionless number, η, in the modified factor in the μ-decay matrix element is evaluated by summing the leading terms of all possible graphs, in analogy with the electrodynamics of vector mesons. (M.J.T.)

26270 (BNL-837(p.266-74)) MODELS FOR THE WEAK INTERACTIONS. R. E. Behrends (Yeshiva Univ., New York); and A. Sirlin (Buenos Aires. Universidad).

The properties of the intermediate bosons associated with a general class of theories of weak interactions are discussed. Simple particular models which avoid a well known difficulty and imply a change in the usual definition of universality are considered. (auth)

26271 (BNL-837(p.277-91)) MUON CAPTURE IN HYDROGEN. Carlo Rubbia (European Organization for Nuclear Research, Geneva).

The reaction $\mu^- + p \rightarrow n + \nu$ is considered. Experiments—one type using a liquid hydrogen bubble chamber and determining the total capture rate, the other type using a Brooks neutron counter and measuring the time dependence of the capture process—are reviewed. The evolutions of a μ meson after thermalization in hydrogen and the formation of mesomolecular systems are discussed. Experimental results are compared with the predictions of the universal Fermi interaction theory. (M.J.T.)

26272 (BNL-837(p.299-302)) LEPTONIC DECAYS IN THE UNITARY SYMMETRY SCHEME. Nicola Cabbibo (European Organization for Nuclear Research, Geneva).

A theory of leptonic decays based on unitary symmetry for strongly interacting particles is presented. Branching ratios for the decays of Λ and Σ are predicted. (M.J.T.)

26273 (BNL-837(p.344-52)) THE INVESTIGATION OF PION BETA-DECAY. A. F. Dunaitsev, V. I. Petrukhin, Yu. D. Prokoshkin, and V. I. Rykalin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R.).

Investigations of the decay $\pi^+ \rightarrow \pi^0 + e^+ + \nu$, $\pi^0 \rightarrow 2\gamma$, are reported. The positron spectrum is presented. The branching ratio is found to be $\lambda = (1.30 \pm 0.35) \times 10^{-8}$. (M.J.T.)

26274 (BNL-837(p.355-77)) LEPTONIC DECAY OF HYPERONS. A. Rousset (Paris. Ecole Polytechnique).

Decays of the type (hyperon) → (baryon) + (lepton or antilepton) + (neutrino or antineutrino) are considered. Presently available experimental information on spectra and branching ratios for Σ, Λ^0, and Ξ decay is examined. Predictions of the UFI theory and of the SU(3) model for branching ratios are compared with experimental results. (M.J.T.)

26275 (BNL-837(p.410-26)) THE PRESENT STATUS OF Ξ DECAY. Harold K. Ticho (California. Univ., Los Angeles).

Present experimental data on Ξ's are correlated. The number of particles identified so far, the values of mass, mean life, and asymmetry parameter, and the uncommon decay modes, if any, for the Ξ^- and Ξ^0 hyperons are presented. The Ξ^- spin and decay parameters are derived. (M.J.T.)

26276 (DESY-64/6) SINGLE PION PRODUCTION BY LINEARLY POLARIZED PHOTONS AT HIGH ENERGIES. P. Stichel (Germany. Physikalisches Staatsinstitut, Hamburg). May 1964. 7p.

There exists a one-to-one correspondence between the dependence of the single-pion-photoproduction amplitude on the linear polarization of the photons at high energies and small momentum transfer in the direct channel $\gamma + N \rightarrow \pi + N$ on one hand and the parity of the exchanged particle-system in the crossed channel $\gamma + \pi \rightarrow N + \bar{N}$ on the other. (auth)

26277 (ORNL-3582(p.127-8)) A SEARCH FOR Λ-NUCLEON RESONANCE. H. O. Cohn and W. M. Bugg (Oak Ridge National Lab., Tenn.).

A search was made for a Λ-nucleon resonance in K^- + He interactions. Due to the complexity of the final state and low statistics, no convincing evidence for such a resonance was found. (auth)

26278 (ORNL-3582(p.129)) PARITY IN Σ^- INTERACTION WITH HELIUM. H. O. Cohn, W. M. Bugg, and R. D. McCulloch (Oak Ridge National Lab., Tenn.).

The angular distribution of the Λ-decay products for Λ's produced in Σ^- + He is found to be isotropic; thus no evidence for parity nonconservation in this strong interaction is found. (auth)

26279 COULOMB SCATTERING OF DIRAC PARTICLES. D. M. Fradkin, T. A. Weber, and C. L. Hammer (Ames Lab., Ames, Iowa). Ann. Phys. (N. Y.), 27: 338-61 (May 1964). (IS-753)

The continuum Coulomb wave function in the Johnson and Deck form—a matrix operator acting on a plane wave spinor—is discussed. General relations for the elastic differential cross section, the asymmetry parameters, and the precession and nutation of polarization are developed. An expansion of the asymptotic wave function correct to third order in $\lambda = \alpha Z$ for all Born parameters $\nu = \alpha Z/\beta$ is obtained. This expansion involves a two parameter function $T(\theta, \nu)$ which in turn may be expanded for small ν to give

results previously obtained by Johnson, Weber, and Mullin. On the other hand, a large ν asymptotic expansion of $T(\theta,\nu)$ valid for $|2\pi\nu| > 1$ permits a discussion of the non-relativistic limit. Both the small and large approximations substantially agree for $|\nu| \simeq \frac{1}{2}$. Consequently, these two approximations may be used to span the whole range of Born parameters. The asymptotic Born parameter approximation predicts markedly different scattering behavior for electrons and positrons. A striking feature is that functions pertaining to electron scattering are oscillatory in the scattering angle θ while the positron functions are not. In particular, the oscillations in the asymmetry parameter for electron scattering obtained numerically by Sherman are contained in the analytical approximate form. Also, the approach to the Rutherford cross section is different than that quoted by Mott and Massey. (auth)

26280 A METHOD OF ASYMPTOTIC EXPANSION OF FOURIER-TYPE INTEGRALS. T. A. Weber, D. M. Fradkin, and C. L. Hammer (Ames Lab., Ames, Iowa). Ann. Phys. (N. Y.), 27: 362-76(May 1964). (IS-724)

The expansion for large v of integrals of the type $G(v) = \int_a^b e^{ivf(t)} g(t)\,dt$ is discussed. The method consists of using the mapping $z = f(t)$ so that the integral in question becomes $G(v) = \int_a^b e^{ivz} F(z)\,dz$. This integral is evaluated by distorting the path of integration into the complex plane in such a way that finite segments, emanating from endpoints or paralleling branch cuts, lie along paths characterized by $\mathrm{Im}(vz) = \text{constant}$. Integration over segments involving encircled singularities z_i (or endpoints) with the minimum $\mathrm{Im}(vz_i)$ give the major contributions to the integral. The integral over such a segment is approximated in terms of an expansion with an accuracy depending on the magnitude of v and the distance between the encircled singularity and the nearest neighboring singularity. A modification of this procedure gives an accuracy dependent on the distance to the next nearest neighboring singularity. The first approach is applicable to widely separated singularities while the second approach is useful for two closely spaced singularities. As an illustrative example, the method is applied to an integral which arises in connection with Coulomb scattering. (auth)

26281 PRODUCTION AND SCATTERING IN SIMPLE MODELS. II. TWO-BODY CHANNELS. H. Chew (Princeton Univ., N. J.). Ann. Phys. (N. Y.), 27: 377-84(May 1964).

A simple soluble model with three coupled two-particle channels is discussed. The model is intended to simulate the $I = \frac{1}{2}$ s-wave part of the associated production processes $\pi + N \to \Lambda + K$, $\pi + N \to \Sigma + K$, and elastic πN scattering. The cusps are exhibited explicitly, and their sizes are easily seen to be small for reasonable values of the coupling constants. The influence of the two-body inelastic channels on πN elastic scattering is discussed and contrasted with that of three-body inelastic channels. (auth)

26282 ANALYSIS OF THE PHOTOPRODUCTION OF POSITIVE PIONS. G. Hoehler and W. Schmidt (Technische Hochschule, Karlsruhe, Ger.). Ann. Phys. (N. Y.), 28: 34-59(June 5, 1964).

The experimental data for π^+-production on protons are compared with the result of a calculation in which only the large and rather well known terms of the dispersion theory are taken into account, namely the pole term and the contribution of the resonant magnetic dipole transition. It turns out that the deviations are not larger than the discrepancies between the results of different laboratories. Therefore, it is concluded that the present experimental accuracy does not allow a reliable test of the theoretical expressions for the other terms in the production amplitude or a determination of the $(\gamma,3\pi)$-coupling constant λ. Earlier attempts to determine Λ are criticized because a "subtraction constant" is neglected, which is large according to Ball's approach. Also, in the usual evaluation of the dispersion theory of Chew, an approximation is used which leads to a qualitatively wrong result in the closely related case of πN-scattering. The relation of this calculation to the phenomenological method of Gourdin is also discussed. (auth)

26283 STUDIES OF MANY-CHANNEL SCATTERING. Hans A. Weidenmueller (Univ. of California, Berkeley and Universität, Heidelberg). Ann. Phys. (N. Y.), 28: 60-115 (June 5, 1964).

A simple case of many-channel scattering is investigated. The Riemann surface is constructed, upon which the elements of the S matrix are meromorphic functions. The structure of the S matrix near a pole is investigated in detail. It is shown that both the scattering wave functions and the elements of the S matrix are dominated by the "wave function" for the "decaying state" in the vicinity of such a pole. The physical content of the Breit-Wigner formula is discussed in the framework of these ideas. Levinson's theorem is generalized to the case of many-channel scattering. As a by product, it is shown that poles of the S matrix close to the positive real axis of the physical sheet cause the sum of eigenphase shifts of the S matrix to increase approximately by π over the width of the resonance as the energy increases. (auth)

26284 PHENOMENOLOGICAL EIGENFUNCTIONS FOR THE DEUTERON GROUND STATE. B. Eriksson, L. Hulthén, and N. Johansons (Royal Inst. of Tech., Stockholm). Arkiv Fysik, 25: 463-71(1964).

In continuation of work initiated by Sugawara and Hulthén modified wave functions of analytic form and correct asymptotic behavior are tried and adjusted to deuteron data: binding energy, effective range, electric quadrupole moment, and various values of the D-state probability. Earlier and present results are checked by calculating the shape dependent parameter. The potentials corresponding to the wave functions in question are derived from the Schrödinger equation on simplest possible assumptions and are briefly discussed. (auth)

26285 TWO-BODY BOUND STATE AND SCATTERING WITH NON-CENTRAL FORCES. A. F. Nicholson (Philips Electrical Industries, Hendon, S. Australia). Australian J. Phys., 17: 1-7(Mar. 1964).

A class of local potentials containing central, tensor, and L.S parts is considered, for which the n-p coupled radial equations for the $\pi = -1$ states of any J reduce to uncoupled equations over a region R of r. If R is finite all potentials may be of short range. The possibilities of describing the deuteron and n-p scattering by this model are considered. It is shown that the observed values of the high-energy mixing parameters ϵ_3, ϵ_4 may be fitted without solving the wave equations. (auth)

26286 ANGULAR DISTRIBUTIONS IN THE REACTION $\bar{p} + p \to \pi + \rho$. A. Pindor (Univ. of Warsaw). Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 12: 61-5(1964).

The angular distributions for the reaction $\bar{p} + p \to 3\pi$ are calculated, assuming that a ρ resonance emerges in the final state. A table of possible final states for the three variations of the reaction—$\bar{p} + p \to \pi^+ + \rho^+$, and $\bar{p} + p \to \pi^0 + \rho^0$—is given. Equations for the differential cross

sections are obtained for unpolarized and polarized atoms. (M.J.T.)

26287 ON AN IDENTITY IN THE THEORY OF COLLISIONS. J. Beckers (Universite, Liege). Bull. Soc. Roy. Sci. Liege, 32: 886-98(1963). (In French)

A general formula similar to Kato's identity for the phase shifts, but concerning the scattering amplitudes, is developed. The formula is not restricted to the case of central potentials and can be extended to complex collisions. It gives indications about the approximations made in variational methods for scattering amplitudes. For the case of a central potential, correspondence with the Kato identity is established. (auth)

26288 THE $K^+ + p \rightarrow K^0 + \pi^+ + p$ EFFECTIVE CROSS SECTION IN THE VICINITY OF THE $^3/_2$–$^3/_2$ RESONANCE IN THE ISOBARIC MODEL. Gisele Bordes and Jacques Poyen. Compt. Rend., 258: 2491-4(Mar. 1964). (In French)

The differential cross section $d\sigma/dW^2$ ($K^+ + p \rightarrow K^0 + \pi^+ + p$) was calculated with the aid of an improved isobaric model, by using the parameters (coupling constant and resonance mass) determined by π^+p scattering. The curve obtained takes into account the position of the maximum and the width of the peak of this cross section observed experimentally for K^+ at 1.14 Bev/c. (tr-auth)

26289 NONLOCAL EFFECTS FOR MOELLER AND BHABHA SCATTERINGS AT HIGH ENERGIES. Pham Xuan Yem. Compt. Rend., 258: 2495-7(Mar. 1964). (In French)

The cross sections for Moeller and Bhabha scatterings were studied between 1 and 10 Bev in the laboratory system. The ratios $(d\sigma^{(2)}_{NL} + d\sigma^{(4)}_{L})/(d\sigma^{(2)}_{L} + d\sigma^{(4)}_{L})$, which vary between 75 and 95%, do not depend only on the coupling parameter A, but also on form factors introduced in the nonlocal interaction. (tr-auth)

26290 RATE OF PRODUCTION AND NATURE OF HYPERNUCLEI PRODUCED IN INTERACTIONS OF K^- MESONS AT 3 Bev/c WITH THE NUCLEI OF IONOGRAPHIC EMULSIONS. Germain Baumann, Jean-Paul Gerber, Henri Brau, and Pierre Cueer (Laboratoire de Chimie Organique et Laboratoire de Chimie Theorique, Faculte des Sciences, Rennes, France). Compt. Rend., 258: 2798-2805(Mar. 9, 1964).

The production rate of hypernuclei is 2.5 ± 0.5%. This rate is less than that of the production of hypernuclei in the interactions of K^- of much lower energy. The distribution of paths show that the mean energy of the hypernuclei is higher with fewer heavy hypernuclei than in the interactions of lower energy K^- mesons. (tr-auth)

26291 LARGE ANGLE RAYLEIGH SCATTERING OF 662 kev GAMMA RAYS. S. Anand, M. Singh, and B. S. Sood (Punjab Univ., Chandigarh, India). Current Sci. (India), 32: 401-2(Sept. 1963).

The cross section for Rayleigh scattering of 662-kev gamma rays at 95, 110, and 127° was determined to investigate the dependence of Rayleigh scattering on atomic number. For the three angles, the cross section was proportional $Z^{5.1\pm0.1}$, $Z^{5.7\pm0.2}$, and $Z^{5.7\pm0.2}$, respectively. The agreement of the results with some calculations is discussed. (D.C.W.)

26292 RAYLEIGH SCATTERING OF 662 kev GAMMA-RAYS FROM DIFFERENT ELEMENTS. M. Singh, S. Anand, and B. S. Sood (Punjab Univ., Chandigarh, India). Current Sci. (India), 33: 77-8(Feb. 5, 1964).

The cross section for the elastic scattering of 662-kev gamma rays was measured at 4 to 12° for Fe, Cu, Ag, Sn, and Pb and at 30 to 90° for Sn, W, Hg, and Pb to investigate the Z dependence of Rayleigh scattering. The Rayleigh scattering cross sections are tabulated, together with an index to the power of Z. (D.C.W.)

26293 INFLUENCE OF INCOHERENT SCATTERING ON THE POLARISATION OF ELASTIC SCATTERING OF GAMMA-RAYS. M. Singh, S. Anand, and B. S. Sood (Panjab Univ., Chandigarh, India). Current Sci. (India), 33: 239-40 (Apr. 20, 1964).

The experimental values previously obtained for the polarization of gamma elastic scattering from lead were lower than those given by refined calculations, the difference perhaps being attributable to the contribution of L-shell electrons for which exact calculations were not available. Scattering experiments were performed which show that incomplete elimination of incoherent scattering tends to lower the experimental values and that L-shell electron effects, if any, are comparatively small. (D.C.W.)

26294 LORENTZ INVARIANT ANALYTIC S-MATRIX AMPLITUDES. Klaus Hepp (Eidgenössische Technische Hochschule, Zurich). Helv. Phys. Acta, 37: 55-73(1964).

A canonical decomposition of analytic relativistic S-matrix elements (for processes between non-massless particles with arbitrary spins) into a finite sum of Lorentz invariant amplitudes multiplied with covariant polynomials was investigated. Necessary and sufficient conditions are given for the existence of a set of amplitudes, which are analytic functions in the Lorentz invariants. The restrictions by Π-, T-, and C-invariance and by the Pauli principle are discussed, and results are presented for spin$^1/_2$-spin$^1/_2$ scattering. The theory of multivalued holomorphic tensor fields over the complex mass shell and their analytic continuation are considered. (auth)

26295 RADIATION LENGTH IN NUCLEAR EMULSIONS. R. K. Puri (Indian Inst. of Tech., New Delhi). Indian Inst. Tech. (Delhi), Phys. Bull., 11p. [Dec. 15, 1963].

The radiation length for 800-Mev electrons in G5 nuclear emulsion was determined to be 31.5 ± 0.9 mm. The value calculated for standard emulsion at room temperature and 58% relative humidity is, however, 29.2 mm. The experimental difference is attributed to the difference of the relative humidity from the 58% assumed for the calculation. Calculations for varying relative humidity and an examination of the dependence of the scattering constant on relative humidity support this interpretation. (D.C.W.)

26296 RADIATION OF A VARIABLE MAGNITUDE CHARGE MOVING WITH A CONSTANT VELOCITY IN A MEDIUM. A. Ts. Amatuni G. M. Garibyan, and S. S. Elbakyan. Izv. Akad. Nauk Arm. SSR, Ser. Fiz. Mat. Nauk, 16: 101-12(1963). (In Russian)

Formulas were developed that take into consideration a charge varying in magnitude due to a condition in which the main charge moves at a constant rate while a part of it is retained in the medium, as in electron-photon showers or variable electron clusters in plasma. Formulas for angular and frequency distributions of radiation are analyzed. (R.V.J.)

26297 ON THE TOTAL NUMBER OF QUANTA EMITTED IN LAMINATED MEDIA. V. A. Dzhrbashyan. Izv. Akad. Nauk Arm. SSR, Ser. Fiz. Mat. Nauk, 16: 113-15 (1963). (In Russian)

A variation is suggested for the Ter-Mikaelyan formula for determining the total number of quanta emitted by a relativistic particle per unit of trajectory in a laminated medium. (R.V.J.)

26298 ANALYSIS OF PROTON COMPTON SCATTERING ACCORDING TO THE ISOBAR MODEL. G. G.

Arushanov (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 1, 61-5(1964). (In Russian)

A proton Compton effect of 0.2 to 1 Bev was studied within the limits of the isobar model. The diagram for p-γ elastic scattering according to the isobar model is included. The initial collisions form a positive parity isobar (N^*) with $^3/_2$ spin. The Compton effect cross sections at 90° (cms) are in good agreement with experimental data. The curves for differential scattering at 250, 320, and 750 Mev were calculated and compared with experimental data. The polar amplitudes related to π^0, σ^0, and η^0 meson exchange were not considered, however, they obviously do not contribute enough to influence the results. (R.V.J.)

26299 EQUATIONS FOR π-N SCATTERING AT LOW ENERGIES. M. K. Aliev, A. G. Grigor'yants, and L. Sh. Khodzhaev (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 1, 66-76(1964). (In Russian)

The Cini-Fubini method (Ann. of Phys., 3: 352(1960)) was adjusted to Mandelstam representation in order to obtain a system of coupled integral equations for s and p waves for π-N scattering and s and p waves for the annihilation channel in the nonphysical region. The partial amplitudes were expressed by forward and backward scattering amplitudes (the differential method). The term describing π-π interactions in the obtained equation was investigated. (R.V.J.)

26300 ON THE ROLE OF π-π INTERACTIONS IN THE PRODUCTION OF FERRETTI TRIPLE PIONS. E. V. Beter and U. G. Gulyamov (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 1, 90-2(1964). (In Russian)

The cross section for primary π meson dissociation into three pions in a Coulomb nuclear field according to $\pi^- + A \rightarrow \pi^- + \pi^+ + \pi^- + A$ reaction was evaluated. It was assumed that the secondary pion total energy at the center of inertia is 1 Bev. The principal factor determining the strong π^+-π^- interactions is the ρ^0 resonance. A process model is taken in which the ρ^0 is a real particle (m = 750 Mev) produced by virtual photon exchange with fast decaying charged pions. The cross section for Ferretti 3π production by 17-Bev primary pions (in lead) is $\sigma_c \approx 0.5$ mb, or one order of magnitude lower than the experimental evaluation of the upper limit of the cross section by F. Baldassare et al (Nuovo Cim., 21: 459(1961)). (R.V.J.)

26301 ASYMPTOTIC CONVERGENCE AND THE COULOMB INTERACTION. John D. Dollard (Princeton Univ. N. J.). J. Math. Phys. (N. Y.) 5: 729-38(June 1964).

A definition of asymptotic convergence is given for nonrelativistic time-dependent scattering problems involving Coulomb potentials. Convergence proofs were found both for potential and for n-body multichannel scattering. For pure Coulomb potential scattering, the Møller wave matrix is computed explicitly and found to have its usual meaning. (auth)

26302 PERTURBATION THEORY FOR STRONG REPULSIVE POTENTIALS. Steven Weinberg (Univ. of California, Berkeley). J. Math Phys. (N. Y.), 5: 743-7(June 1964).

A conformal mapping of the coupling-constant plane is used to rearrange the Born series. The new series is guaranteed to converge for any decent repulsive potential. The first few terms do well in actual calculations of the scattering length. (auth)

26303 A REMARKABLE CONNECTION BETWEEN KEMMER ALGEBRAS AND UNITARY GROUPS. P. Roman (Boston Univ.). J. Math. Phys. (N. Y.), 5: 777-83(June 1964).

Starting from a Kemmer algebra generated by n elements, a new algebra generated by $\frac{1}{2}(n^2 + n)$ elements is derived. This algebra has only one irreducible representation which is of dimension (n + 1). This representation is equivalent to the first elementary representation of the infinitesimal operators of the unitary group in a space of (n + 1) dimensions. Omitting the identity element, one of course obtains the first elementary representation of the unitary unimodular group in a space of (n + 1) dimensions. The procedure is first illustrated for the case of n = 3 and explicit representations of the infinitesimal operators of $U_4(SU_4)$ are obtained. The proof for arbitrary n is outlined. The degenerate case of $U_3(SU_3)$ is discussed. (auth)

26304 GENERALIZATIONS OF THE JOST FUNCTIONS. H. E. Moses (Massachusetts Inst. of Tech., Lexington). J. Math Phys. (N. Y.), 5: 833-?(June 1964).

The Jost functions have proved valuable in the study of the analytic properties of the scattering phase for the radial Schrödinger equation. An alternative definition of the Jost functions is presented, the equivalence of the new definition to the usual one is proved, and the new definition to the one-dimensional Schrödinger equation ($-\infty < x < \infty$), the three-dimensional nonseparated Schrödinger equation, and the three-dimensional nonseparated Dirac equation are generalized. It is hoped that these generalizations lead to a better understanding of the analytic properties of the scattering operator for these and related dynamical systems. The generalized Jost functions are shown to be operators in the variables that label the degeneracy of the continuous spectrum of the hamiltonians that are considered. (auth)

26305 THE PRODUCTION OF π MESONS BY HIGH-ENERGY μ MESONS. A. D. Crossland and G. N. Fowler (Univ. of Newcastle-upon-Tyne, Eng.). Nucl. Phys., 53: 273-86(Apr. 1964).

The cross section for production of mesons (π) by high-energy mesons (μ) is calculated using a model in which ρ or ω meson exchange is the main contributor to the virtual photomeson (π) production cross section. The ρ or ω meson is characterized by a Regge trajectory, and a general dependence of the production process on four-momentum transfer is allowed for following results valid at low energy. A comparison with experiment suggests that the ρ or ω meson trajectory is flat in the region of zero energy. (auth)

26306 VARIATIONAL TREATMENT OF HARD-CORE INTERACTIONS. Yoon Suk Koh and Paul Goldhammer (Univ. of Nebraska, Lincoln). Nucl. Phys., 53: 287-96 (Apr. 1964).

The problem of constructing variational trial wave functions for hard-core interactions is investigated using simple radial functions, the form of which is suggested by perturbation theory. Application is made to the harmonic oscillator with a hard core replacing the center of attraction and to the deuteron using interactions of the Gammel-Thaler type. Results are compared with functions of the type used by Blatt in calculating the triton and indicate that some improvement in these calculations might be obtained by a simple modification in the radial functions. (auth)

26307 MULTIPLE SCATTERING. A. Z. Dolginov and Yu. N. Gnedin (Leningrad Inst. of Physics and Tech.). Nucl. Phys., 53: 317-33(Apr. 1964).

A theory of the multiple scattering of particles passing through a body of finite size is proposed. The quantal multiple-scattering equations are used. It is assumed that the centers of force are distributed randomly and that $N_0 a^2 \lambda \ll 1$, where λ is the wave length of the incident particle, a the amplitude and N_0 the concentration of the centers of force. An explicit expression for the intensity of scattered particles outside and inside the body is obtained. (auth)

26308 ANALYTIC DEUTERON WAVE FUNCTIONS. H. Kottler and K. L. Kowalski (Case Inst. of Tech., Cleveland). Nucl. Phys., 53: 334-6(Apr. 1964).

The numerical deuteron wave function computed using the Yale nucleon-nucleon potential was approximated by simple analytic expressions involving only exponential functions. (auth)

26309 ONE LEPTON CHARGE OR TWO LEPTON CHARGES? E. M. Lipmanov (Volgograd Teachers' Coll., USSR). Nucl. Phys., 53: 350-2(Apr. 1964).

The difference between the schemes of weak interactions with one and two lepton charges is briefly discussed, and a possible experimental manifestation of this difference in the process of meson(μ) decay is indicated. (auth)

26310 SPIN-ZERO PHOTOPRODUCTION PARITY EXPERIMENTS BEYOND THE THRESHOLD REGION. Michael J. Moravcsik (Univ. of California, Livermore). Nucl. Phys., 53: 429-32(Apr. 1964).

It is suggested that parity determining experiments can often be greatly simplified if it is assumed that only the few lowest angular momentum states are important. The assumptions made are not as restrictive as those made for the conventional threshold experiments, and hence the applicability of the schemes is much wider. In particular, a parity experiment is suggested in the photoproduction of spin-zero bosons which does not require polarized photons at all, and which is well within present day experimental techniques. It involves two measurements at the same energy and angle, one measuring the recoil polarization of the fermion, and the other the differential cross section from a polarized target. (auth)

26311 ANALYTICITY OF THE JOST FUNCTIONS FOR THE COULOMB POTENTIAL IN THE COMPLEX ANGULAR MOMENTUM PLANE. C. A. López and I. Saavedra (Universidad de Chile, Santiago). Nucl. Phys., 53: 519-28(Apr. 1964).

The Jost functions for the Coulomb potential and complex angular momentum are constructed and their analytic properties discussed in detail. (auth)

26312 DETERMINATION OF DIRAC'S NEUTRON FORM FACTOR FROM ELECTROPRODUCTION OF PIONS. Ph. Salin (Faculte des Sciences, Bordeaux). Nuovo Cimento (10), 32: 521-44(May 1, 1964).

An isobaric model for photoproduction is now extended to the virtual photon in the case of electroproduction of pions from protons. Numerical results are obtained and discussed in comparison with available data. It is shown that the pion form factor can not be obtained, but that the electric neutron form factor should be negative. (auth)

26313 THE CANONICAL PROPERTY AND ASYMPTOTIC REDUCTION PROCEDURES. W. S. Hellman, G. H. Mullen, and F. M. Coury (Naval Ordnance Lab., Silver Spring, Md.). Nuovo Cimento (10), 32: 609-18(May 1, 1964).

The connection between asymptotic reduction techniques and the canonical structure of interacting fields is examined. The expression for the S-matrix has additional terms when derivative-coupled theories are introduced. It is shown that in the pseudoscalar-pseudovector π-N interaction and meson electrodynamics, these additional terms do not produce contributions to the S-matrix. A modification of the reduction formula for the case of the interactions with derivative coupling is proposed, such as to preserve the canonical commutation properties. (auth)

26314 THE CONSERVATION LAW OF PARITY AND THE CLASSES OF COUPLING CONSTANTS. T. Okabayashi (Tokyo Univ.). Nuovo Cimento (10), 32: 619-27(May 1, 1964).

It is shown that the γ_5-dependent renormalization of the spinor field operator in the parity-violating system, $\psi = Z^{1/2} \exp[-f\gamma_5]\psi_u$ with real parameter f, transforms the interaction $(\bar{\psi}_u\gamma_\mu\gamma_5\psi_u)(\bar{\psi}_u\gamma_\mu(1+\gamma_5)\psi_u)$ into the combination of $(\bar{\psi}\gamma_\mu\psi)^2 - (\bar{\psi}\gamma_\mu\gamma_5\psi)^2$ and $(\bar{\psi}\gamma_\mu(1+\gamma_5)\psi)^2$ and that the strength of the former is stronger than the latter. Further, this method changes the relative sign of the axial-vector and the vector coupling involved in the case of the parity-nonconserving Yukawa interactions. (auth)

26315 A BOOTSTRAP CALCULATION FOR THE Z^- MASS. E. Gotsman (Israel Atomic Energy Commission, Rehovoth). Nuovo Cimento (10), 32: 628-32(May 1, 1964).

The mass of the Z^- particle predicted by the unitary symmetry (US) model is calculated using the bootstrap technique. The results obtained are in agreement with the Okubo mass formula and with the US prediction that Z^- should be a bound state of $\bar{K}-\Xi$, not a resonance. (auth)

26316 REDUCTION OF TRIPLE PRODUCT OF SEPTETS IN THE G_2 SYMMETRY MODEL. A. Kantorovich (Israel Atomic Energy Commission, Yavneh). Nuovo Cimento (10), 32: 633-53(May 1, 1964).

The reduction coefficients of the triple product of the G_2 seven-dimensional irreducible representations, $7 \oplus 7 \oplus 7$, were calculated. The total hypercharge quantum number was introduced in order to characterize mutally orthogonal vectors having the same total isospin and corresponding to the same weight. (auth)

26317 PHOTOPRODUCTION OF CHARGED PIONS FROM DEUTERONS. V. Devanathan (Univ. of Madras) and K. Ananthanarayanan. Nuovo Cimento (10), 32: 723-6(May 1, 1964).

Explicit expressions for the differential cross-sections for the photoproduction of charged pions from deuterons are obtained using the impulse and closure approximations, and the numerical results are compared with experimental results. (auth)

26318 DISPERSIVE APPROACH TO PHOTON-PHOTON SCATTERING. B. De Tollis (Universita, Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo Cimento (10), 32: 757-68(May 1, 1964).

The scattering of light by light is reexamined using the double-dispersion representation and the analytic properties of a fourth-order Feynman diagram. The amplitude corresponding to this diagram is written explicitly in the Mandelstam representation, and the double spectral functions are calculated by means of the Cutkosky rules. Only the amplitude that describes the scattering of linearly polarized photons in a direction perpendicular to the scattering plane is considered. The calculation of this amplitude by the Dyson-Feynman technique is outlined for comparison. (D.C.W.)

26319 K_1^0-K_2^0 TRANSITION IN A COULOMB FIELD. P. T. Matthews and A. Salam (Imperial Coll. of Science and Tech., London). Nuovo Cimento (10), 32: 778(May 1, 1964).

An estimate of the transition form factor in terms of quantities that can be experimentally determined is presented, and a K^0-electron scattering experiment is suggested. (D.C.W.)

26320 EFFECT OF A KK RESONANCE ON THE INTERPRETATION OF THE Φ-MESON. K. Nishimura (Rutgers Univ., New Brunswick, N. J.). Nuovo Cimento (10), 32: 779-81(May 1, 1964).

From a bootstrap calculation in the $K\bar{K}$ system, Barbour and Nishimura concluded that the meson (φ) is probably the isoscalar member of the vector meson octet. A more recent analysis of the $\bar{K} - p \rightarrow \Xi - K$ process required the introduction of a resonance with $J = 0^+$, $I = 1$, and $M \sim 1000$ Mev into the KK system. It is shown that this resonance strengthens the argument for the selection of meson (φ) as the isoscalar member. (D.C.W.)

26321 UPPER LIMITS FOR ANOMALOUS INTERACTIONS OF MUON-NEUTRINOS. H. Faissner (CERN, Geneva), J. Kjellman, A. Staude, and T. Alvaeger. Nuovo Cimento (10), 32: 782-5(May 1, 1964).

A scintillation counter experiment with the neutrino beam of the CERN synchrotron gave an upper limit of $< 2 \times 10^{-37}$ cm^2 for the elastic scattering of muonic neutrinos by protons, assuming an energy-independent cross section. Assuming energy dependence, a cross section of $< 10^{-37}$ cm^2 at 1 Bev was obtained. Some limits on the hypothetical resonance interactions $\nu - n \rightarrow B \rightarrow \mu^- - p$ and $\bar{\nu} - n$ were also established. (D.C.W.)

26322 PARTIAL WAVES SINGULARITIES NEAR j = 1 AND HIGH ENERGY BEHAVIOUR OF THE ELASTIC SCATTERING AMPLITUDE. V. N. Gribov (Ioffe Inst. of Physics and Tech., Leningrad); I. Ya. Pomeranchuk and K. A. Ter-Martirosyan. Phys. Letters, 9: 269-73(Apr. 15, 1964).

The consequences of the Mandelstam suggestion of the presence of moving branch points in the j-plane are investigated. It is assumed that the vacuum pole exists with a trajectory $\alpha(t)$ which passes through the point j = I at t = 0: $\alpha(0) = 1$. Results of an analysis of singularities, based on a use of the multiparticle terms of the unitarity conditions in the t-channel continued into the complex j-plane, are given. (M.J.T.)

26323 UNITARY SPIN ASSIGNMENT FOR THE ω MESON. A. Pignotti and V. Teplitz (Univ. of California, Berkeley). Phys. Letters, 9: 273-4(Apr. 15, 1964).

It is pointed out that the generalization to SU(3) of Chew's dynamical model, for a three-pion resonance, strongly favors the possibility of existence of a unitary singlet ω^0 over the possibility of existence of another octet, in addition to the accepted (ρ, K^*, ϕ^0) octet, including ω^0. (M.J.T.)

26324 BASIC SU_3 TRIPLETS WITH INTEGRAL CHARGE AND UNIT BARYON NUMBER. H. Bacry, J. Nuyts, and L. Van Hove (CERN, Geneva). Phys. Letters, 9: 279-80(Apr. 15, 1964).

It is shown that consideration of two basic SU(3) triplets instead of one permits in a simple way the elimination of the occurrence of fractional Q and N, without losing the elegant structures $3 \times \bar{3} \times 3$ for mesons and $3 \times 3 \times 3$ for baryons, in the Gell-Mann and Zweig triplet model of SU(3) symmetry. A new additive quantum number D and two triplets of particles with spin = ½, N = 1, D = 1 are introduced. (M.J.T.)

26325 A NEW SYMMETRY PRINCIPLE IN PARTICLE PHYSICS TRIO INVARIANCE. Y. Yamaguchi (Tokyo Univ.). Phys. Letters, 9: 281-3(Apr. 15, 1964).

A systematic formulation is presented of the internal symmetry properties among the strongly interacting particles based on the simplest type of finite groups: the permutation group of order 3. The necessity of finite groups and N conservation in the S_3 symmetry are discussed. A two-body system is described. It is concluded that in the N-conserving trio-invariant theory, Q conservation leads to a charge-independent (rather than unitary) and S-conserving Sakata theory, provided that basic interactions are of the Fermi Type. Possibilities of violation of trio invariance or Q conservation are considered. (M.J.T.)

26326 ON THE ANALYTIC PROPERTIES OF THE PION PION SCATTERING AMPLITUDE IN THE COMPLEX ANGULAR MOMENTUM PLANE. J. Kwiecinski and P. Suranyi (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Letters, 9: 283-6(Apr. 15, 1964).

It is shown, using an improved model for the two-particle scattering, that it is in fact possible that the exact scattering amplitude for two pseudoscalar particles is a meromorphic function of the angular momentum l. The sum of the iterated bubble diagrams is used for the kernel. The derived trajectory has a singularity at zero in the renormalized coupling constant. The dependence on s is much weaker than in trajectories given by a Yukawa potential or by a $g\varphi^3$ type theory. (M.J.T.)

26327 A MECHANISM OF INDUCTION OF SYMMETRIES AMONG THE STRONG INTERACTIONS. E. C. G. Sudarshan (Inst. of Mathematical Sciences, Madras and Brandeis Univ., Waltham, Mass.). Phys. Letters, 9: 286-8 (Apr. 15, 1964).

A model like Cutkosky's model of N vector mesons interacting among themselves in such a manner that each meson may be considered a bound state of pairs of vector mesons is derived. Electric charge conservation is not used as a postulate in the derivation. But once the Jacobi identity is demonstrated, a maximal commuting set of generators of the Lie algebra may be chosen to define the conserved charges (additive quantum numbers). (M.J.T.)

26328 SEARCH FOR Y_1^* RESONANCES. Margaret H. Alston, Angela Barbaro-Galtieri, Arthur H. Rosenfeld, and Stanley G. Wojcicki (Univ. of California, Berkeley). Phys. Rev., 134: B1289-94(June 22, 1964). (UCRL-11137)

A search was made for a doubly charged $\Sigma\pi$ resonance produced in $\bar{K}N$ interactions. Data in hydrogen with incident K^- momentum of 1.51 and 1.70 Bev/c, and in deuterium with a K^- momentum of 1.49 Bev/c, show no evidence for any T = 2 resonance for a $\Sigma\pi$ mass below 1900 Mev. (auth)

26329 MASS AND INTERACTIONS OF THE W MESON. G. Feinberg (Cambridge Univ., Eng.). Phys. Rev., 134: B1295-1302(June 22, 1964).

Some possible sources of a large mass for the weak vector meson, or W meson, are studied. Several possibilities are found, including the following: The self-mass of the W, which cannot be zero, is large. The weak interactions generate a large self-mass. The electromagnetic interactions generate a large self-mass. The W undergoes a strong self-interaction which generates a large self-mass. Some experimentally observable consequences of these possibilities are discussed. (auth)

26330 S-MATRIX POLES CLOSE TO THRESHOLD. William R. Frazer and Archibald W. Hendry (Univ. of California, San Diego, La Jolla). Phys. Rev., 134: B1307-14(June 22, 1964).

Two-channel processes are studied to determine whether sizeable peaks can be produced in elastic scattering for one of the channels by threshold effects arising from the second

channel (taken to be in an S-wave state). The problem is first examined by means of a simple model whose analytic properties can easily be deduced. It is found that, when all the particles are stable, large cusps occur if there is a pole of the S matrix on an unphysical sheet in the vicinity of the inelastic threshold. The cusps become woolly when one of the particles in the second channel is allowed to be unstable. Similar results are obtained in a calculation using an ND^{-1} formulation. These S-matrix poles correspond to virtual states of the particles in the inelastic channel, their positions on the unphysical sheets depending on the force of interaction between the particles. It is further suggested that some of the peaks observed in experiment may be of this type, having their origins in inelastic thresholds rather than direct particle resonances. In particular, the Y_0^* at 1815 Mev and the K_1K_1 peak near threshold may be manifestations of this. (auth)

26331 SIMPLE $\pi\pi$ SELF-CONSISTENT CALCULATION USING THE STRIP APPROXIMATION. Louis A. P. Balázs (California Inst. of Tech., Pasadena). Phys. Rev., 134: B1315-19(June 22, 1964).

Using a simple representation derived from the strip approximation by Singh and Udgaonkar (and resembling the Cini-Fubini approximation), an integral equation can be obtained for the partial-wave amplitude. This can be solved by the N/D method. By making certain approximations, the resulting equations, when combined with the requirement of self-consistency, lead to simple algebraic equations for determining the parameters of the ρ resonance. The only parameter is the width of the strip. This, however, can be calculated by using the Chew-Frautschi principle of maximum strength. (auth)

26332 MESON–BARYON SYSTEMS AND THEIR RESONANCES. I. P. Gyuk and S. F. Tuan (Purdue Univ., Lafayette, Ind.). Phys. Rev., 134: B1320-3(June 22, 1964).

Meson–baryon systems of angular momentum L are analyzed by considering the relevant crossing matrices. The resultant bootstrap calculations yield the correct quantum numbers for the observed array of particles and resonances. Specifically it is found that $Y_1^*(1385)$ decays into $(\pi\Lambda)$ but not $(\pi\Sigma)$. Furthermore, a Y_1^* resonance in $(\frac{5}{2}-)$ is predicted which may accommodate the recently discovered $Y_1^*(1765)$. (auth)

26333 THEORY OF LOW-ENERGY π-π SCATTERING. Kyungsik Kang (Indiana Univ., Bloomington). Phys. Rev., 134: B1324-38(June 22, 1964).

A self-contained examination of the π-π scattering problem is made on the basis of the S-matrix conjecture, using analyticity, elastic unitarity, and crossing symmetry. The crossing-symmetry relations are derived without using the double-dispersion relations. The nearest singularity hypothesis is adopted. Inelastic effects and distant left-hand singularities are crudely incorporated by means of polynomials. Nearby left-hand singularities are chosen in such a way the functional forms are correct near the branch point with unknown parameters. The amplitude so constructed satisfies elastic unitarity exactly in one channel; the parameters are adjusted through self-consistency conditions derived from crossing symmetry. By use of the inverse amplitude, simple amplitudes are constructed, and solutions are found by hand calculation. A p-wave resonance is generated for negative values of λ with $|\lambda| < 0.39$. Solutions exhibit the development of I = 0 s-wave bound states for negative values of λ with $|\lambda| \geq 0.44$ and of I = 1 p-wave bound states for negative values of λ with $|\lambda| \geq 0.39$. The range of λ, $-0.3 \lesssim \lambda < 0.1$, is found to be self-consistent. (auth)

26334 OBSERVATION OF THE REACTION $\bar{p} + d \rightarrow \Lambda + \Sigma^- + \bar{\Xi}^+$. T. C. Bacon (Brookhaven National Lab., Upton, N. Y.), H. W. K. Hopkins, D. K. Robinson, E. O. Salant, A. Engler, H. E. Fisk, C. M. Meltzer, and J. B. Westgard. Phys. Rev., 134: B1339-40(June 22, 1964). (BNL-7831)

A $\bar{p}d$ interaction involving all three nucleons in the production of the hyperons $\Lambda + \Sigma^- + \bar{\Xi}^+$ was observed in a deuterium-filled bubble chamber. All the subsequent strangeness-changing decays, and the final $\bar{p}n$ annihilation, appeared in the chamber. (auth)

26335 THE FIFTH INTERACTION: ORIGINS OF THE MASS BREAKING ASYMMETRY. Yuval Ne'eman (California Inst. of Tech., Pasadena). Phys. Rev., 134: B1355-7 (June 22, 1964).

The relative success of the SU_3 mass formula, and the relevant choice of an asymmetric solution by spontaneous breakdown and bootstrap equations are explained by the suggestion of an additional interaction, similar to electromagnetism but some ten times stronger, mediated by a vector meson coupled to the strangeness S = Y – B current. The possibility that this interaction may also be responsible for the muon mass is investigated. (auth)

26336 THREE-BODY SCATTERING AMPLITUDE: I. SEPARATION OF ANGULAR MOMENTUM. Roland L. Omnes (Univ. of California, Berkeley). Phys. Rev., 134: B1358-64(June 22, 1964). (UCRL-11162)

The angular momentum is separated in the Fadeev equations for the three-body scattering amplitude. The method used is symmetrical with respect to the three particles and does not introduce any relative angular momentum of two particles. The resulting equations are well suited to a numerical solution and can be applied to a study of the problem of overlapping resonances. They also provide a natural starting point for an extension of the three-body scattering amplitude to complex angular momentum. (auth)

26337 RESTRICTIONS IMPOSED BY THE OPTICAL THEOREM ON EXCHANGED QUANTUM NUMBERS. Ronald F. Peierls and T. L. Trueman (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 134: B1365-7 (June 22, 1964).

Crossing relations for particles of arbitrary spin are used to express the amplitudes for $A + B \rightarrow A + B$ in terms of amplitudes for the crossed reaction $A + \bar{A} \rightarrow B + \bar{B}$. Using the optical theorem, it is demonstrated that crossed amplitudes with positive parity, positive G parity, and positive signature cannot be negligible for forward scattering. Implications of this result for the spin dependences of high-energy scattering amplitudes are discussed. (auth)

26338 CONTRIBUTION OF CHARGED VECTOR BOSONS TO THE PHOTON PROPAGATOR. Mirza A. Baqi Beg (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev., 134: B1368-70(June 22, 1964).

The effect of charged vector bosons on the photon propagator is considered within the framework of the ξ-limiting formalism. The two cases, of vanishing and nonvanishing primary anomalous magnetic moment, are contrasted, and several experimental consequences are discussed. (auth)

26339 K^-p CHARGE-EXCHANGE SCATTERING AT 1.80 Gev/c. P. M. Dauber (Univ. of California, Los Angeles). Phys. Rev., 134: B1370-1(June 22, 1964).

Measurements were made of the differential and total K^-p charge-exchange cross section at 1.80 Bev/c. The total cross section found was 1.55 ± 0.09 mb. Terms including $\cos^{10}\theta_{K^0K^-}$ were required in fitting the $\bar{K}^0$ angular distribution. (auth)

26340 $Y_1^*(1385\ Mev)$: STUDY OF SPIN AND PARITY BY MOMENT ANALYSIS FOR J = 5/2, 3/2, AND 1/2. Janice B. Shafer and Darrell O. Huwe (Univ. of California, Berkeley). Phys. Rev., 134: B1372-6(June 22, 1964). (UCRL-11105)

The possibility that the $Y_1^*(1385\text{-Mev})$ spin is $\frac{5}{2}$ was investigated. Identification of the Y_1^* as an $F_{5/2}$ state is excluded; the $D_{5/2}$ assignment is not required; and $J = \frac{5}{2}$ is found rather unlikely. Of the states $P_{3/2}$, $D_{3/2}$, $S_{1/2}$, and $P_{1/2}$, only $P_{3/2}$ is acceptable, the excluded hypotheses having confidence levels of order 10^{-6} or 10^{-7}; this conclusion strengthens slightly the earlier selection of $P_{3/2}$, based chiefly on study of the θ_A dependence of two components of the decay Λ's polarization. This more definitive report results from the application of the moment analysis of Byers and Fenster to a sample of 895 Y_1^* decays obtained from $K^- - p$ interactions in the 72-in. bubble chamber. (auth)

26341 SELF-CONSISTENT CALCULATION OF THE MASS AND WIDTH OF ω FROM ρ AND π. M. L. Mehta (Tata Inst. of Fundamental Research, Bombay). Phys. Rev., 134: B1377-80(June 22, 1964).

A self-consistent calculation of the mass and the width of ω following the approximations of Balázs is reported. The mass and the width found are $m_\omega \approx 650$ Mev and $\Gamma_\omega \approx 1.3$ Mev, respectively, which are to be compared with the experimental values $m_\omega \approx 780$ Mev and $\Gamma_\omega \approx 9.5$ Mev. The D function has a second zero indicating a ghost state at ~820 Mev. This perhaps is due to the neglect of the cut arising from the pion in the crossed channel. (auth)

26342 BOUND STATES AND REGGE TRAJECTORIES IN A VECTOR MESON EXCHANGE MODEL. I. APPLICATION TO THE $K\bar{K}$ SYSTEM. Richard C. Arnold (Univ. of California, Los Angeles). Phys. Rev., 134: B1380-92 (June 22, 1964).

Partial-wave dispersion relations, extended to non-integer angular momenta are utilized, together with assumptions on the dominance of one-meson exchange to compute the properties of bound states. The exchanged mesons are represented by Regge poles, which lead to a set of equations of generalized Fredholm type when the N/D technique is applied. Bound-state energies in a one-channel system of two spinless particles are computed, as well as the slope of the Regge trajectory which passes through each bound state; the latter is accomplished by an extension of the N/D formalism to angular momenta in the neighborhood of the positive integers. Threshold questions are treated by an approximation for more complex diagrams. The integral equations are solved without further approximations by electronic computer methods. The model is applied to the φ meson as a nearly bound state of the $K\bar{K}$ system in the present work and yields information on S-wave $K\bar{K}$ interactions. Application to future bootstrap calculations, the reason for computing the Regge slopes, is discussed, as well as the relationship to the strip approximation. (auth)

26343 DETERMINATION OF SPIN AND PARITY OF HYPERONS USING POLARIZED PROTON TARGET. G. Shapiro (Univ. of California, Berkeley). Phys. Rev., 134: B1393-5(June 22, 1964). (UCRL-11244)

Relations are derived to determine the spin and relative intrinsic parity of a fermion, such as the cascade particle, produced in association with a spinless boson by the reaction of a second spinless particle with a polarized proton target. Inequalities are derived for general spin parity assignments between P, the polarization of the final fermions, when produced from a unpolarized target; P', the dependence of the rate of the reaction upon target polarization; and D, the correlation between initial and final polarization. Use is made of Bohr's theorem of R invariance. (auth)

26344 MANY-PARTICLE SELF-CONSISTENT MODEL. Richard H. Capps (Northwestern Univ., Evanston, Ill.). Phys. Rev., 134: B1396-1406(June 22, 1964).

The number and general nature of the self-consistency equations that may arise in a universal bootstrap theory of all strongly interacting particles are discussed. There are more equations than there are variables to be determined, so that it may be possible to bypass some of the divergence difficulties of dispersion theory by making use of a sufficient number of the equations. A general method of attacking the difficulties associated with the many-particle aspect of the problem is discussed. A simple first approximation to the method is applied to a model of four multiplets (pseudoscalar meson, vector meson, baryon ground state, and $j = \frac{3}{2}^+$ baryon excited state), under the assumption that unitary symmetry is approximately valid. It is argued that comparison with experiment of the calculated differences in masses of particles within the same multiplet will provide experimental tests that are meaningful in a low-order approximation to the model. It is shown that if the mass splitting of the baryon octet is assumed to be partly self-generating (i.e., not resulting completely from the mass splitting of the meson multiplets), a nondegenerate solution to the model is most likely if there is a large violation of R invariance. (auth)

26345 μ^- CAPTURE RATE IN $(p\mu p)$. Alvin Halpern (Columbia Univ., New York). Phys. Rev., 135: A34-5 (July 6, 1964).

The probability of finding the ortho, L = 1, $(p\mu p)$ system in an $s = \frac{1}{2}$ state at the time of μ^- capture was calculated using the techniques developed by Weinberg. A wave function correct to first order in the muon-to-proton mass ratio was used in the calculation, giving a probability lying between 0.99933 and 0.99952. This result was due to the fact that the contact term in the spin-orbit Hamiltonian masked the effects of the other terms. The errors due to the use of the approximate wave function in this calculation were analyzed qualitatively and found to be small. (auth)

26346 ANALYSIS OF THE 1.0- TO 1.4-Bev π-ρ ENHANCEMENT. Suh Urk Chung, Orin I. Dahl, Lyndon M. Hardy, Richard I. Hess, George R. Kalbfleisch, Janos Kirz, Donald H. Miller, and Gerald A. Smith (Univ. of California, Berkeley). Phys. Rev. Letters, 12: 621-5(June 1, 1964). (UCRL-11371)

The strong π-ρ interaction in $\pi^- + p \rightarrow \pi^+ + \pi^- + \pi^- + p$ was studied at π^- energies of 1.5 to 4.2 Bev. It is found that the enhancement consists of two clearly resolved peaks. Decay of the higher mass system into $K\bar{K}$ is observed in the $K\bar{K}N$ final states. Possible spin and parity assignments for the two states are discussed. (M.J.T.)

26347 A-p ELASTIC SCATTERING. L. Piekenbrock and F. Oppenheimer (Univ. of Colorado, Boulder). Phys. Rev. Letters, 12: 625-7(June 1, 1964).

A report of the Λ-p elastic cross section in the laboratory momentum range of 150 to 400 Mev/c is presented. The Λ's were produced in the interaction $K^- + \text{nucleus} \rightarrow \Lambda + \text{fragments}$. Results of this and two other cross section measurements are compared with cross sections calculated using theoretical potentials; the BGSM potential gives results consistent with the experimental points. (M.J.T.)

26348 UNITARITY AND FORM FACTORS IN THE PRODUCTION PROCESS $\pi + N \rightarrow \rho + N$. Marc H. Ross (Univ. of Michigan, Ann Arbor) and Gordon L. Shaw. Phys. Rev. Letters, 12: 627-30(June 1, 1964).

The reaction $\pi + N \rightarrow \rho + N$ is considered in order to better understand the peripheral model and to elucidate the nature of the ρ resonance. The effects of absorption on this peripheral process are calculated. It is found that, with an appropriate form factor, absorption corrections for cross sections and angular distributions lead to agreement with experiment, and these corrections are very large even at forward angles. This result suggests that the actual ρ may be significantly different in mass and width from the currently accepted values. (M.J.T.)

26349 $\Delta T = \frac{3}{2}$ NONLEPTONIC DECAY. Julian Schwinger (Harvard Univ., Cambridge, Mass.). Phys. Rev. Letters, 12: 630-1(June 1, 1964).

The leptonic decays $\pi^+ \rightarrow \mu^+ + \bar{\nu}$ and $K^+ \rightarrow \pi^0 + e^+ + \nu$, $\pi^0 + \mu^+ + \nu$ are considered. It is pointed out that the observed rate for the $\Delta T = \frac{3}{2}$ nonleptonic decay of K^+ ($\rightarrow \pi^+ + \pi^0$) can be obtained from known leptonic decay rates, without invoking electromagnetic effects. (M.J.T.)

26350 NOTES ON W_3 AND RELATED SYMMETRIES. A. Pais (Rockefeller Inst., New York). Phys. Rev. Letters, 12: 632-4(June 1, 1964).

Some aspects of a possible W_3 strong-interaction symmetry group, where $W_3 = U^{(1)}(3) \otimes U^{(2)}(3)$, are examined on the baryon-meson level, that is, independently of the possible existence of particle triplets of a more fundamental character than baryons and mesons. Strong interactions, electromagnetism, and nonleptonic baryon decays are discussed, using the subgroup SW_3 of W_3. (M.J.T.)

26351 BARYON-EXCHANGE MODEL IN ISOBAR PRODUCTION. A. E. Bussian and F. Oppenheimer (Univ. of Colorado, Boulder). Phys. Rev. Letters, 12: 649-52 (June 8, 1964).

A baryon-exchange model is proposed for the inelastic isobar production process $M + B \rightarrow M' + B'$, where M and B indicate meson and baryon respectively. The model is compared with the experimental results for $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ and $\pi^- + p \rightarrow \pi^- + \pi^+ + n$. The model is consistent with the experimental results on these and other reactions. (T.F.H.)

26352 POSSIBLE RESONANCE AT 829 Mev IN ΛK^0 PRODUCTION. G. T. Hoff (Univ. of Chicago). Phys. Rev. Letters, 12: 652-6(June 8, 1964).

Resonance effects in the interaction $\pi^- + p \rightarrow \Lambda + K^0$ at an incident pion energy of 829 Mev are studied. It is hypothesized that a ΛK resonance exists, with a cms energy of 1650 Mev and a spin-parity of $\frac{5}{2}^+$. A preliminary attempt is made to identify this resonance with the F_{5} resonance in pion-nucleon interactions. The resonance in question dies off rapidly both below and above 829 Mev pion energy. (T.F.H.)

26353 TWO-BODY EFFECTIVE MASS SPECTRA IN THE PRODUCTS OF THE REACTION $\gamma + p \rightarrow p + \pi^+ + \pi^-$. R. Del Fabbro, M. de Pretis, R. Jones, G. Marini, A. Odian, G. Stoppini, and L. Tau (Laboratori Nazionali del Sincrotrone, Frascati, Italy). Phys. Rev. Letters, 12: 674-8 (June 15, 1964).

The $\pi^+ - \pi^-$ invariant mass spectrum in the interaction $\gamma + p \rightarrow p + \pi^+ + \pi^-$ was measured in the interval from 280 to 600 Mev. The data can be interpreted in terms of a π-π resonance at about 380 Mev with I = J = 0. (D.C.W.)

26354 β DECAY OF THE Σ^+ AND Σ^- HYPERONS AND THE VALIDITY OF THE $\Delta S = \Delta Q$ LAW. U. Nauenberg (Columbia Univ., New York), P. Schmidt, J. Steinberger, S. Marateck, R. J. Plano, Henry Blumenfeld, and Leo Seidlitz. Phys. Rev. Letters, 12: 679-81(June 15, 1964).

The decays of hyperons ($\Sigma^\pm$) produced in the capture of stopping mesons (K^-) in a hydrogen bubble chamber were studied. The momentum distributions of the hyperon decay tracks (differential decay rates) are shown. One possible event of the type $\Sigma^+ \rightarrow e^+ + n + \nu$ was observed. The branching ratios $\Sigma^- \rightarrow n + e^- + \nu / \Sigma^- \rightarrow \pi^- + n$ and $\Sigma^+ \rightarrow n + e^+ + \nu / \Sigma^+ \rightarrow \pi^+ + n$ were found to be $1.37 \pm 0.34 \times 10^{-3}$ and 1.03×10^{-4}, respectively. The $\Delta S = -\Delta Q$ decay rate was determined to be $\leq 6\%$ of the $\Delta Q = \Delta S$ decay rate. (D.C.W.)

26355 A POSSIBLE THEORETICAL ARGUMENT WHICH ELIMINATES THE (HITHERTO) UNREALIZED REPRESENTATIONS OF SU(3). F. Englert and R. Brout (Université Libre, Brussels). Phys. Rev. Letters, 12: 682-3(June 15, 1964).

It is proved that only certain representations of the group U(n) are factorizable into a representation of the baryon gauge group (the group of total phase) and a representation of another group. The latter representation automatically realizes the adjoint group of SU(n). The construction of the factorizable representations for U(3) is outlined, and the condition of factorizability as a possible requirement in a physical theory is considered. (D.C.W.)

26356 RARE DECAYS OF THE μ MESON. Jules Halpern (Univ. of Pennsylvania, Philadelphia). Proc. Am. Phil. Soc., 107: 427-30(Oct. 15, 1963).

An angle and energy analysis of all the events observed when 10^{10} mesons (π^+) were stopped in Li showed that, with 50% confidence, the decay of a meson (μ) into an electron and a photon is less than 2 parts in 10^8 of normal decay. Apparently some new prohibition is in operation, probably the existence of a mu neutrino and an electron neutrino. (auth)

26357 VANISHING GRAVITATIONAL CONTRIBUTION TO THE MASS FOR A CLASS OF ELECTRON MODELS IN GENERAL RELATIVITY. F. R. Tangherlini (Duke Univ., Durham, N. C.). Proc. Phys. Soc. (London), 83: 1079-80(June 1964).

It is shown that static, spherically symmetric models of the electron in general relativity have the property that the mass of the electron may be calculated from an integral over the matter energy density alone, if the matter tensor satisfies certain boundary conditions and the condition that energy density equals radial stress. The analysis is independent of the pseudotensor concept. (auth)

26358 ISOBAR PRODUCTION IN BOSON-NUCLEON COLLISION. Takeshi Ebata (Tohoku Univ., Sendai). Progr. Theoret. Phys. (Kyoto), 31: 197-212(Feb. 1964).

An attempt is made to understand the successful results of the isobar model analysis by Olsson from the dynamical aspect. The assumption is used that the isobar is predominantly produced through the exchange of the I = 1, J = 1 di-pion system between the incident boson and the target nucleon, if there is no serious kinematical restriction against the exchange and if there are no other resonances. The model is applied to the reactions $\pi^+ p \rightarrow 2\pi N$ and $KN \rightarrow K\pi N$ in the lower energy region. The rise of the inelastic cross section is calculated. The fit with the experiment is excellent, especially for $\pi^+ p$ reaction. Although, in the model, the isobar is produced mainly in P-state, the results of the usual isobar model, where S-state production is assumed, is little changed. And the validity of the model becomes quite plausible, if the par-

ticular angular distribution of the isobar does not contradict experiment. Partial wave projection of the amplitude is performed, and it is shown that in fact the isobar is produced dominantly in $P_{1/2}$ and $P_{3/2}$ near the threshold; the elastic amplitudes for $P_{1/2}$ and $P_{3/2}$ states, rather than $D_{3/2}$ are perhaps to be seriously affected by the rise of the inelastic process. The relation between the model and the usual treatments of final state interaction is discussed, together with treatment of the lowest graph of the vector meson theory. (auth)

26359 A NEW TRIANGLE RELATION FOR NONLEPTONIC HYPERON DECAY AMPLITUDES AS A CONSEQUENCE OF THE OCTET SPURION AND THE R SYMMETRY. Hirotaka Sugawara (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 31: 213-21(Feb. 1964).

A triangle relation $T_\Lambda = 2T_{\Xi^-} + \sqrt{3}T_{\Sigma^0}$ is obtained for the nonleptonic decay amplitudes of $\Lambda \to p + \pi^-$, $\Sigma^+ \to p + \pi^0$, and $\Xi^- \to \Lambda + \pi^-$. This relation is shown to be in excellent agreement with the experiment, especially when $\gamma_{\Sigma^+\to p\pi^0} > 0$. The assumptions are the octet spurion hypothesis and R symmetry. (auth)

26360 INFINITESIMAL SPONTANEOUS MASS SPLITTING. [PART] I. Mahiko Suzuki (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 31: 222-34(Feb. 1964).

On the assumption that the baryon mass splitting can be approximated to be infinitesimal in comparison with the mean baryon mass, not with a cutoff momentum, the spontaneous mass splitting is investigated in the model in which the octet baryons and mesons interact under the two interactions of Yukawa type, fully symmetric under SU_3 transformations. In some cases the Gell-Mann-Okubo formula follows, independently of the cutoff momentum. Among others, the Σ-Λ mass splitting and, therefore, all the relative spacings of the baryon mass splitting can be fitted to the experimental values near the D-coupling limit. (auth)

26361 ON BOUND STATES IN THE FULL SYMMETRY THEORY. Mineo Ikeda (Hiroshima Univ.), Takayoshi Maekawa, Yoshihiko Miyachi, Kei Senba, and Naomi Shohno. Progr. Theoret. Phys. (Kyoto), 31: 235-46(Feb. 1964).

The approach which was previously proposed for treating the problem of bound states is extended to the case in which there are three kinds of basic particles: protons, neutrons, and Λ-particles. A general form of a four-Fermion interaction is obtained by assuming full symmetry among the basic particles. Then, the particle-antiparticle two-body system is discussed in the vector coupling which contains a form factor, and the integral equations in the momentum representation are derived. Solutions are obtained in the special case of contact interaction. (auth)

26362 A THEORY OF WEAK INTERACTION BASED ON THE POSSIBLE EXISTENCE OF STRONG OCTET GAUGE BOSONS AND WEAK INTERMEDIATE BOSONS. Mitsuru Hama and Sho Tanaka (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 31: 247-55(Feb. 1964).

Possible models of the weak interaction are proposed, which are based on the Sakata model and are able to explain the characteristic features of weak interactions, including the $|\Delta I| = \frac{1}{2}$ rule and the occurrence of both $\Delta S/\Delta Q = \pm 1$ phenomena in the nonleptonic and leptonic decays of the strange particles. In this theory an octet local gauge invariance combined with the SU(3) symmetry for the basic baryons of the Sakata model is assumed, which necessarily introduces the octet vector gauge bosons. The weak currents of the baryon-boson system are formed in a certain relation with the octet conserved vector currents, which are constituted of baryons and octet gauge bosons. An essential difference is noted between the structures of the $\Delta S/\Delta Q = 1$ currents and the $\Delta S/\Delta Q = -1$ currents, in that the latter currents ($I = \frac{3}{2}$, $S = 1$) must be constituted of only the octet gauge bosons. This situation seems to have an intimate connection with the selection rule at the leptonic decay of the kaon($K_{\mu 4}$) reported recently. (auth)

26363 AN EXTENSION OF FEYNMAN-BUNGE-CORBEN'S RELATION REGARDING THE POSITION-OPERATOR OF DIRAC ELECTRON TO ARBITRARY OPERATORS. [PART] I. Hisaiti Yamasaki (Kyusyu Dental Coll., Kitakyusyu, Japan). Progr. Theoret. Phys. (Kyoto), 31: 322-3(Feb. 1964).

The relation is extended by taking a suitable operator $\bar{Q}$ for an arbitrary Dirac operator Q. The general formulas for $\bar{Q}$ are presented, together with the results for spin and momentum. (D.C.W.)

26364 AN EXTENSION OF FEYNMAN-BUNGE-CORBEN'S RELATION REGARDING THE POSITION-OPERATOR OF DIRAC ELECTRON TO ARBITRARY OPERATORS. [PART] II. Hisaiti Yamasaki (Kyusyu Dental Coll., Kitakyusyu, Japan). Progr. Theoret. Phys. (Kyoto), 31: 324-5(Feb. 1964).

The physical meaning of the results of the preceding article is discussed. (D.C.W.)

26365 ANTI-SHRINKAGE OF THE p-$\bar{p}$ DIFFRACTION SCATTERING. Tōsaku Kunimasa and Takesi Ogimoto (Osaka Univ.). Progr. Theoret. Phys. (Kyoto), 31: 325-6 (Feb. 1964).

It is shown that the forward peak of high-energy p-$\bar{p}$ scattering has a tendency to increase. (D.C.W.)

26366 A TEST FOR THE R-REFLECTION INVARIANCE. Keiji Kikkawa (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 31: 328-9(Feb. 1964).

A formula is presented by which the R-reflection invariance in the octet scheme of the SU(3) symmetry can be tested if the electromagnetic moments of the baryons are known. It is concluded that R-invariance is violated in the original SU(3) interaction. (D.C.W.)

26367 THE "FOURTH" BARYON, SAKATA MODEL AND MODIFIED B-L SYMMETRY. [PART] I. Ziro Maki (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto), 31: 331-2(Feb. 1964).

A possible unified scheme of elementary particles based on four fundamental baryons χ_0, $x = (p_0, n_0, \Lambda_0)$ and four leptons (ν_0, ν_1, e^-, μ^-) is proposed. (D.C.W.)

26368 THE "FOURTH" BARYON, SAKATA MODEL AND MODIFIED B-L SYMMETRY. [PART] II. Ziro Maki (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto), 31: 333-4(Feb. 1964).

Some consequences of the scheme presented in the preceding article for strong and weak interactions are outlined. (D.C.W.)

26369 NUCLEAR MATTER PROPERTIES. Nestor Azziz (Pennsylvania State Univ., University Park). Rev. Mex. Fis., 12: 109-38(1963).

The Moszkowski and Scott approximation of Brueckner's many-body theory was put in a suitable form for calculation when the two-body model has tensor spin orbit and quadratic spin orbit coupling. (auth)

26370 ON THE ENERGY LOSS OF ELECTRICALLY CHARGED PARTICLES IN PIEZOELECTRIC CRYSTALS.

Joachim Seebass (Technische Hochschule, Brunswick). Z. Naturforsch., 19a: 284-93(Mar. 1964). (In German)

Due to the coupling of electric and elastic fields in piezoelectric crystals a charged particle moving in a piezoelectric crystal will lose energy by emission of mechanical radiation (ultrasonic waves). After introducing some simplifying assumptions (the crystals were considered elastically isotropic and the influence of the piezoelectric crystal on the electric field of the particle was neglected), this energy loss was computed for cubic crystals, and it is shown to be in the range of 10 to 100 kcv/cm. (auth)

26371 ON THE DIFFUSION THEORY OF SPIN PARTICLES: NUMERICAL CALCULATION OF THE RELAXATION CONSTANT FOR FAST ELECTRONS. H.-D. Kupatt (Universität, Mainz). Z. Naturforsch., 19a: 301-14(Mar. 1964). (In German)

The relaxation paths, l_0, l_{11}, etc., of the Waldmann diffusion theory for spin-$\frac{1}{2}$ particles were determined numerically for electrons of velocity $v/c = 0.4, 0.5, 0.6, 0.7, 0.8$, and 0.9, which were elastically scattered on neutral atoms with order numbers $Z = 13$, 48, and 80. As the scattering potential the exponentially screened Coulomb potential $V = (-Ze^2/r) \exp(-\lambda r)$ was assumed; for the screening parameters $\lambda/\lambda_0 = 1.00$, 1.16, 1.59, and 1.80 were suggested; $1/\lambda_0$ is the Thomas-Fermi length of the scattered atom. The evaluation was based on the second Born approximation of the Mott scattering operator for the noted atomic potential. Where this is inaccurate, the Mott functions of scattering in a pure Coulomb field listed by Sherman are consulted. The Born approximation for scattering on screened fields was then only used in the small-angle region. Also for scattering on the Thomas-Fermi potential and the Hartree potential ($Z = 80$), the relaxation paths were determined. (tr-auth)

26372 PHOTOPRODUCTION OF PIONS IN FORWARD DIRECTION AND REGGE POLES. G. Kramer and P. Stichel (Universitat, Hamburg). Z. Physik, 178: 519-41(1964).

Photoproductions of single pions for high energies and small momentum transfer were considered. The production amplitude was approximated by exchange of ρ, ω, φ, and π mesons in the crossed channel $\gamma + \pi \rightarrow N + \bar{N}$. These mesons were treated either as elementary or as Regge poles. The angular distribution was calculated in the high energy limit and is discussed in detail. (auth)

26373 PHOTOPRODUCTION OF ρ- AND ω-MESONS IN THE PERIPHERAL MODEL. H. Joos and G. Kramer (Deutsches Elektronen-Synchrotron, Hamburg and Universitat, Hamburg). Z. Physik, 178: 542-50(1964).

Photoproduction of ρ and ω mesons on nucleons was considered. The possible matrix elements according to the peripheral model were constructed and the cross section was calculated. The π, η, σ (ABC), and vector meson exchange was taken into account. The angular distribution for the decay pions of polarized ρ's is discussed with particular reference to peripheral production. (auth)

26374 NEUTRON-PROTON MASS DIFFERENCE VIA DISPERSION RELATIONS. George Louis Schrenk. Thesis, Bloomington, Ind., Indiana Univ., 1963. 118p.

The calculational techniques of dispersion relations have been applied to the problem of calculating the neutron-proton mass difference. The mass shift due to the single nucleon intermediate state is calculated by using the experimental electromagnetic form factors F_1 and F_2, as defined by Hofstader, for the regions in which they have been measured and by adding various high energy tails for the unmeasured regions. Considerable insight into the single nucleon intermediate state contribution is gained by also studying the mass shift in terms of the form factors G_E and G_M, as defined by Sachs. The sign ambiguity in the determination of G_{E_N} and its effect on the mass shift is pointed out. The conclusion drawn is that -1.58 Mev $\leq m_N - m_P \leq -1.09$ Mev; hence, the single nucleon intermediate state cannot explain the observed mass shift of $m_N - m_p = 1.29$ Mev. The pion-nucleon intermediate state is also investigated by assuming it to be a spin $\frac{3}{2}$, isospin $\frac{3}{2}$ single particle state. The decay of this state is subsequently treated by introducing a Breit-Wigner resonance shape which fits the well-known 3-3 resonance. The calculational techniques of dispersion relations are used. Form factors H_E and H_M are defined and their determination from the experimental cross section for pion production in electron-nucleon scattering is covered in detail. Expressions are fully developed for calculating the mass shift from this state. For the proton some crude experimental data is analyzed to obtain the estimate that 0.07 Mev $\leq \delta m_p \leq$ 0.17 Mev. Isotopic spin arguments show that for any isospin $\frac{3}{2}$ state the contributions to the mass shift are equal for the proton and for the neutron. Therefore, this state cannot contribute to the neutron-proton mass difference; only isospin $\frac{1}{2}$ pion-nucleon states can contribute. Based on the calculated magnitude of δm_p and on the importance of the 3-3 resonance in pion-nucleon scattering, the conclusion is drawn that if the neutron-proton mass difference is entirely electromagnetic in origin, many more higher order intermediate states are required in the calculation of the mass difference. (Dissertation Abstr.)

26375 PION EXCHANGE CURRENTS IN DEUTERON PHOTODISINTEGRATION: A DISPERSION THEORY. Malcolm Harris Skolnick. Thesis, Ithaca, N. Y., Cornell Univ., 1963. 129p.

A dispersion theoretic treatment of the amplitudes describing photomagnetic disintegration of the deuteron at energies very near threshold has been developed. The method enables one to include the effects of meson exchange currents in the photodisintegration or equivalent n-p capture process. The calculation is motivated in part by knowledge of the deviations of the magnetic moments of the two and three body nuclei from the sums of the moments of the constituent nucleons. It has been conjectured that these discrepancies are attributable to pion exchange currents. In addition one is appraised of the disagreement between the theoretical prediction and the experimental result for the n-p capture cross section for thermal neutrons. In this process, the magnetic dipole amplitude is dominant at threshold. It is recognized that magnetic transitions should be much more indicative of exchange effects than electric transitions since the former are indeed electromagnetic interactions with a current distribution, and the latter involve interactions with a charge distribution. Thus it was sought to attack the general problem of exchange currents by first isolating the effects of these currents in the above mentioned scattering process. The twelve invariant amplitudes which describe photodisintegration or n-p capture are related to their nonrelativistic counterparts by decomposing the relativistic nucleon spinors. The nonrelativistic amplitudes are then related to the partial wave eigen amplitudes. Only the dipole terms are retained. One may thus find a particular dipole amplitude as a linear combination of the relativistic ones. This allows discussion of the dipole amplitudes in terms of their analytic and invariant structure of their relativistic counterparts.

It is shown that at threshold the photomagnetic amplitude is essentially the isovector transition to $1s_{\frac{1}{2}}$ final state. Solutions to the dispersion relation for this amplitude are found using several different approximations: First, one may neglect all higher order effects which serve to define the unphysical cut and consider only the contribution from the Born poles. Next, one may condense all the higher order effects into a single interaction pole. The single experimental cross section value for thermal neutrons may be used to relate the position and residue of this pole in a single functional relationship by recalculating the solution to the dispersion relation with this pole included. Finally, one may treat contribution of the pion exchange currents using the Mandelstam representation, and recalculate the dispersion relations once again. This latter treatment is based upon the approximation that only the anomalous tip of the spectral function is effective in providing modifications in the physical region close to threshold. It is shown that the pion exchange terms are the dominant contributors to the spectral function in the anomalous region. The solution obtained in this approximation yields an amplitude and thus a cross section which is in agreement with the experimental value. Within the framework of this colloquy, it is suggested that deuteron photodisintegration offers unique opportunities to an investigation of exchange current effects. One may capitalize on the existing experimental and theoretical lore, and, within the framework of the S-matrix approach, implement field theoretic methods which possess great power. Photodisintegration is perhaps one of the simplest processes in which one may utilize electromagnetic interactions to study details of the nuclear force. (Dissertation Abstr.)

26376 PION PRODUCTION IN NEUTRON–PROTON COLLISIONS IN THE NEIGHBORHOOD OF 1.6 Bev/C. James Evans Parker. Thesis, East Lansing, Mich., Michigan State Univ., 1963. 134p.

A study has been made of single pion production by neutrons on protons in a hydrogen bubble chamber. The momentum spectrum of incident neutrons has a peak at 1.6 Bev/c with a full width of 0.7 Bev/c in the laboratory system. The angular and laboratory kinetic energy distributions of the final state nucleons show the peripheral nature of the interaction. Good agreement was obtained when the data were compared with the peripheral interaction theory of Selleri and Ferrari using a cutoff function. The effective mass distributions show the presence of the 3,3 isobar and indicate that using experimental cross sections and angular dependnce for the scattering vertex gives a slightly better agreement than using a simple Breit-Wigner resonance. Laboratory kinetic energy distributions show that a cutoff function which reduces the cross-section at high momentum transfer is necessary. (Dissertation Abstr.)

26377 A STUDY OF THE REACTION $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ AT 310 AND 377 Mev. Barry Clark Barish. Thesis, Berkeley, Calif., Univ. of California, 1963. 66p.

A liquid hydrogen target was bombarded with negative pions from the Lawrence Radiation Laboratory 184-in. synchrocyclotron. Proton distributions for the reaction $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ were measured at incident pion energies of 310 and 377 Mev. The protons from this reaction were identified in a scintillation counter telescope by a combination of dE/dx, range, and time-of-flight methods. At 310 Mev, selected proton energy intervals were taken at laboratory angles of 15 and 22.5 deg. At 377 Mev, distributions in energy from 60.5 to 163.5 Mev at angles from 10 deg to the kinematic limit were measured. The total cross sections obtained were: 0.14 ± 0.07 mb at 310 Mev, and 0.37 ± 0.03 mb at 377 Mev. The total cross section values for $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ are approximately 6 times smaller than for $\pi^- + p \rightarrow \pi^- + \pi^+ + n$. These values are in good agreement with the theoretical predictions of a pion-pion interaction model by Schnitzer in which his parameters are chosen to fit the total cross section and π^+ angular distribution in the reaction $\pi^- + p \rightarrow \pi^- + \pi^+ + n$. (Dissertation Abstr.)

26378 INTERACTIONS OF HEAVY NUCLEI HAVING ENERGY GREATER THAN 1000 Gev. Raymond Lee Fricken. Thesis, Baton Rouge, La., Louisiana State Univ., 1963. 76p.

Several characteristics of the interactions of heavy primary nuclei and fragments obtained in two emulsion stacks exposed to cosmic radiation near the top of the atmosphere are described. The energy per nucleon of the heavy nuclei was obtained by applying the Castagnoli formula to the composite angular distribution of the particles produced in the interactions of the primary nucleus and the multiply charged fragments. The mean energy per nucleon of this sample of events was found to be 4600 Bev. A lower limit of the percentage of events in which the charged particles are emitted asymmetrically in the center of mass system was estimated to be 38 ± 8 per cent. A χ^2 test revealed that the deviation from symmetric emission is statistically significant. A possible explanation in terms of a mass disparity between the actually colliding particles was given. The mean energy of the produced charged particles in the center of mass system was found to be 1.0 ± 0.3 Bev. It was found that the center of mass system angular distribution of charged particles produced in the singly charged fragment interactions is of the type $P(\bar{\theta})d\bar{\Omega}\alpha(\sin\bar{\theta})^{-1}d\bar{\Omega}$. The slope of the integral angular distribution of these tracks was determined to be 1.1 ± 0.2. This result, together with the result for the energy spectrum of such particles determined in the ICEF experiment, gives a confirmation of the assumption of constancy of mean transverse momentum. The mean transverse momentum of the singly charged fragments was found to be 0.7 ± 0.2 Bev/c. This result may indicate that the fragments have somewhat higher mean transverse momentum than the produced particles whose mean transverse momentum has been established to be 0.4 ± 0.1 Bev/c. It was found that on the average the Castagnoli energy underestimates the true energy by a factor of 2.2 ± 0.5 for events having $N_h > 5$ and overestimates the true energy by a factor of 1.3 ± 0.2 for events having $N_h \leq 5$. The mean multiplicity of produced charged particles in the singly charged fragment interactions was found to be 9.0 ± 1.7 for events having $N_h = 0,1$ and 14.4 ± 2.1 for events having $N_h \leq 5$. The value for $N_h = 0,1$ events is the same as that found by Lohrmann at 250 Bev for nucleon-nucleon collisions. The result for $N_h \leq 5$ events, together with others at lower energies, indicates that the mean charged particle multiplicity in nucleon-nucleus collisions is consistent with the $E^{\frac{1}{4}}$ energy dependence predicted by the statistical and hydrodynamical theories and the log E dependence predicted by the multiperipheral model. The inelasticity $\langle K_{ch}^1 \rangle$ (the fraction of the available energy radiated as produced charged particles in the laboratory system) was determined to be 0.23 ± 0.06 corresponding to a total inelasticity of 0.38 ± 0.10. A method was discussed whereby it might be possible to determine the effective mass of a subpart of the nucleon actually participating in the collision by examining the detailed structure of the inelasticity distributions. An attempt was made to estimate the energy of the heavy nuclei from the angular divergence of the fragments. For the multiply charged fragments the energy determined by this

method was consistent with that determined from the composite angular distribution. For the singly-charged fragments the energy calculated from the angular divergence of the fragments underestimated the previously determined energy by a factor of 4.7 ± 1.0. This result, together with a similar result obtained by Rybicki at 200 Bev, indicates that at these high energies the fragments are no longer produced by a simple evaporation process in the mirror system. (Dissertation Abstr.)

26379 THE EFFECTS OF FINAL STATE INTERACTIONS ON SCATTERING PROCESSES. John Raymond Gillespie. Thesis, Berkeley, Calif., Univ. of California, 1963. 86p.

Particles in the incident or final channel of a scattering process may interact to modify the experimental spectra. These interactions provide information of particles not susceptible to direct scattering experiments. Accounting for such interactions often reveals details of production processes otherwise masked by the final-state effects. The various theoretical techniques developed to accommodate these interactions are analyzed, compared, and extended to give an unified approach to the subject. There are two general approaches to the problem: (a) factorization from the transition matrix of the wave function describing the interacting pairs, and (b) application of time-reversal invariance and unitarity to the multichannel S-matrix to relate the phases of various elements. In the study of the former approach, extensive use is made of Jost function techniques, which provide considerable insight into the relation of the various enhancement factors arising from final-state interactions. They are especially useful in an assessment of various approximation methods and in an understanding of the distinction between the effects of attractive and repulsive interactions. The symmetry of initial and final-state effects is examined. The methods for a single interacting pair are extended to accommodate multiple simultaneous final-state interactions by means of separable and additive potentials. Analyticity and unitarity applied to Born calculations are shown to yield singular integral equations whose solutions provide a convenient correction for final-state effects; application is made to the photodetachment of negative ions. Finally, the possibility of detecting pair interactions in final states whose kinematics are incompletely determined because of unobserved particles is discussed. (Dissertation Abstr.)

26380 HIGH FREQUENCY REGION OF THE BREMSSTRAHLUNG SPECTRUM. Ramzi Jibrail Jabbur. Thesis, Stanford, Calif., Stanford Univ., 1963. 77p.

An examination of the matrix elements for the transition probability for various high energy Coulomb-field vertex processes shows their equivalence in the limit in which there is an almost complete transfer of momentum between a photon and an electron or positron. These include such processes as high-energy photoeffect, electron and positron bremsstrahlung, and pair production in which one member of the pair carries almost all the incident photon energy. In calculating the matrix elements, the modified Coulomb plane wave is used for the high-energy particle while the low-energy particle wave function is taken as the sum of partial wave solutions of the Dirac equation. An expression in the form of a double integral over the entire plane is derived for the high-energy cross section for any of the processes above. From this, K-shell and L_I-subshell photoeffect cross sections are derived as a power series in $a \equiv \alpha Z$, α is the fine structure constant and Z the atomic number, neglecting only relative order a^4 terms. The good agreement between these series analytic results and exact numerical calculations encourages the use of the same canonical formalism for the bremsstrahlung problem. In the high-frequency region of the bremsstrahlung spectrum, the incident high-energy particle transfers almost all of its energy to the photon k and goes into a final state of low energy $\epsilon = (1 + q^2)^{1/2}$ (with $\hbar = c = m_e = 1$). If the final electron is not observed, the cross section can be written as a sum of the cross sections for emission of the electron into definite partial wave states without any interference terms: $\sigma = \Sigma\, \sigma_{jl}$. Starting from the same double integral as in the photoeffect, expressions are derived for the electron bremsstrahlung partial cross sections over final angular momentum states as a power series in a and the final momentum q, neglecting only relative order terms a^4, a^2q^2, and q^4 to the total cross section σ. Since angular momentum state l contributes in a relative order a^{2l} to σ this requires summation only over final s and p states: $\sigma = \sigma(s) + \sigma(p)$. Numerical calculations for $\sigma(s)$ carried out on the IBM 7090 computer give very good agreement with the analytic power series expansion, thus providing further confidence in the analytic results. The total electron bremsstrahlung cross section at the tip (q = 0) is given by $\sigma(s + p) = 8\pi\, e^2\, a^3\, a^{2\gamma_1} k\, \Gamma(2\gamma_1 + 1)\, e^{-\pi a}(1 - 0.837\, a + 1.457\, a^2 + 0.255\, a^3)$ where $\gamma_1 = (1 - a^2)^{1/2}$, k the photon energy. The corresponding result for high-energy positron bremsstrahlung is obtained by changing a to −a in the series expansion, and multiplying the normalization by the factor $\exp[2\pi a - 2\pi a\, \epsilon/q]$, thus giving a vanishing cross section at the tip. It is also shown that the cross section for high-energy pair production in which the positron carries off most of the energy is identical with that of electron bremsstrahlung. Similarly, the pair production process in which the electron carries off almost all the photon energy corresponds to positron bremsstrahlung. It follows from the above then that the production of low-energy positrons is suppressed. (Dissertation Abstr.)

26381 PION PRODUCTION BY 910 Mev/c K-PLUS MESONS ON PROTONS. Brandt Kehoe. Thesis, Madison, Wis., Univ. of Wisconsin, 1964. 156p.

The process $K^+ + p \rightarrow K^0 + p + \pi^+$ was investigated using film from the exposure of a propane bubble chamber to a beam of K mesons of momentum 910 Mev/c. Interactions of this type, in which the K^0 decayed in the chamber via the charged K_1^0 mode, were measured and analyzed. Only events which fit the hypothesis that the target proton was a hydrogen nucleus were accepted. The beam intensity and characteristics were determined by measuring tau decays, $K^+ \rightarrow \pi^+ + \pi^+ + \pi^-$, of the beam particles. The number of acceptable production events was determined to be 250 ± 18 and the total K^+ track length was $(8.19 \pm 0.46) \times 10^6$ cm. Thus the indicated cross section for $K^+ + p \rightarrow K^0 + p + \pi^+$ at this momentum is 1.93 ± 0.19 mb. The production events were compared to the model for isobar (1238 Mev π-nucleon resonance) production by rho-meson exchange suggested by Leo Stodolsky and J. J. Sakurai. The agreement of the data with the predictions of this model was excellent. Distributions tested include the isobar decay and production angles, effective masses for all three particle pairs, and momentum transfer. The energy dependence of the cross section in this region was also found to be in agreement with the model. (Dissertation Abstr.)

26382 A MEASUREMENT OF THE PRESENCE OF THE RETARDATION TERM IN POSITIVE PION PHOTOPRODUCTION USING POLARIZED X-RAYS OF 227, 240, 342, AND 373 Mev. Raymond Calvin Smith. Thesis, Stanford, Calif., Stanford Univ., 1963. 116p.

Measurements of π^+ photoproduction at resonance and

below have shown the desirability of a retardation term in fitting the measured angular distributions. An alternative and additionally convincing measurement can be made using polarized bermsstrahlung. Measurements are made at different center-of-mass angles of the ratio of π^+ production perpendicular and parallel to the electric field vector. It can be shown that if only S and P waves are present, the photoproduction cross section for polarized photons can be expressed as $\sigma_{polarized} = \sigma_{unpolarized} - \alpha \sin^2\theta \cos 2\varphi$ where θ is the cm angle of meson production and φ is the angle between the plane of polarization and the plane of production. This leads to the following relation: $P_\alpha = (R - 1/R + 1)\ (\sigma_{unpolarized}/\sin^2\theta)$ where P is the polarization defined as $(N_t - N_r)/(N_t + N_r)$, and N_t and N_r are the numbers of photons produced with the electric field perpendicular and parallel to the meson production plane. R is the ratio of yields $(N_t\,\sigma_\perp + N_r\,\sigma_{||}/N_t\,\sigma_{||} + N_r\,\sigma_\perp)$, where $\sigma_{||}$ refers to the cross section for meson production parallel to the polarization of the photon which produced it ($\varphi = 0$) and $\sigma_\perp$ refers to the cross section for meson production perpendicular to the polarization of the photon which produced it ($\varphi = \pi/2$). Measurements at different angles should give the same value of $P\alpha$ if no higher order angular momenta are present. It is not necessary that the polarization be known if it remains constant during the measurements; $\sigma_{unpolarized}$ can be evaluated from other angular distribution measurements. This measurement was made in two energy ranges, using a beam of polarized bremsstrahlung from the Stanford linear accelerator. The results are summarized in Table I. The values of $P\alpha$ at 45° differ significantly from those at 90 and 135°, indicating the need of higher angular momenta. The differences between the 90 and 135° points are less, as would be expected if a retardation term is introducing the higher angular momenta. The lower energy data are not as significant as the higher energy data since it is expected that the closer the photon energy is to threshold, the more probable it would be to fit the data without higher angular momenta. A nonphenomenological analysis shows the asymmetry ratios consistent with the predictions of the relativistic dispersion relation.

Table I. Values of $P\alpha$ (P is constant at each energy.)

	k = 227 Mev	k = 240 Mev	k = 342 Mev	k = 373 Mev
45°	0.90 ± 0.24	0.97 ± 0.29	2.71 ± 0.39	2.92 ± 0.37
90°	0.73 ± 0.17	0.54 ± 0.21	1.85 ± 0.28	1.17 ± 0.29
135°	0.77 ± 0.31	0.07 ± 0.04	1.49 ± 0.38	1.03 ± 0.44

(Dissertation Abstr.)

26383 ANALYTIC PROPERTIES IN ENERGY AND ANGULAR MOMENTUM OF PARTIAL WAVE AMPLITUDES. John Robert Taylor. Thesis, Berkeley, Calif., Univ. of California, 1963. 95p.

The elastic scattering of particles governed by the Schrödinger equation is considered and the analytic properties of the partial wave amplitude, as a function of energy E and angular momentum l, are examined. The partial wave amplitude is represented in the N over D form and the analytic properties of the Regge poles, which occur when the function D vanishes, are derived. The possibility of the residue of a Regge pole vanishing and the amplitude having an indeterminacy point is discussed. In particular it is shown that the amplitude of a Yukawa potential can have indeterminacy points only when l is a negative half integer. Finally, an examination is made of the connection between fixed poles of the D function and high-energy (or weak coupling) limits of Regge poles and it is shown that one Regge pole of a Yukawa potential tends to each negative integer at high energies. Corresponding results are given for more general potentials, and some consideration is made of the extent to which the results derived would be valid in more general theories. (Dissertation Abstr.)

26384 THE PHENOMENOLOGICAL DESCRIPTION OF A RELATIVISTIC THREE PARTICLE EMISSION. Nicholas Karayianis. Thesis, Bloomington, Ind., Indiana Univ., 1963. 68p.

It is known that the allowed nuclear β-decay spectra can be derived by statistical considerations alone, i.e., by assuming the decay products to occupy uniformly the phase space consistent with energy and momentum conservation. A similar attempt by Fermi to derive the electron spectrum of muon decay, however, failed to give a correct result. The failure of the statistical procedure in muon decay is not wholly unexpected, but it is somewhat surprising that the result obtained is not even a member of the highly general Michel family of spectra. The Michel spectra constitute the most general result which can be obtained by an interaction of the Fermi type, and they may well be expected to include an isotropic emission of the product particles. A phenomenological analysis of the emission of three relativistic particles is made consistent with the principles of energy, momentum, and angular momentum conservation. To ensure this requirement, full use is made of Wick's relativistic three particle angular momentum states. A general three particle emission is described by expanding into Wick's states the result of the S matrix (representing an arbitrary interaction) acting on some initial state. The unknown S matrix elements serve as the arbitrary expansion coefficients. The result is expressed in phase space by a further expansion into free, single particle plane wave states. The general result is specialized to a local interaction for spin one-half particles and is compared with the general S matrix approach to the calculation of a decay rate. Particular emphasis is paid to the Lorentz invariant aspects of the problem. Within this framework, it is shown that, in a decay, the phase space is necessarily limited by correlations between the momenta of the emitted particles. Thus, the incorporation of angular momentum (neglected in the statistical considerations) into a correct relativistic description of a three particle emission results in a decay rate which is inconsistent with an isotropic emission of the product particles. The statistical assumption of Fermi in calculating the electron spectrum for muon decay is, therefore, in error. The most general energy spectrum of one of the emitted particles in the limit of zero masses is calculated. It is found that the spectrum is identical in form to the parametrized Michel spectra for the electron muon decay. Thus, the parametrized Michel spectra find their basis in the relativistic kinematics of a three particle emission when restricted to a localized interaction. As a consequence, the reporting of experimental data in terms of the Michel parameter assumes significance independent of the specific Fermi interactions on which it was originally based. A further specialization of the general result is made by requiring the product particles to be emitted with negative helicity (antiparticles with positive helicity) to correspond to what is observed in muon decay. The results of this added restriction are to require the electron-neutrino pair to be emitted in a singlet state and to limit the phase space by a correlation $(1 + 2\vec{S}_M \cdot \vec{V}_\nu)(1 - \vec{V}_e \cdot \vec{V}_\nu)$ between the velocities of the antineutrino, electron and neutrino, and the spin projection, $\vec{S}_M$, of the decaying muon. Finally, by recasting the specific Fermi interaction into the form of a three particle wave amplitude representing

the emission, the physical interpretation of the various couplings is made possible. In particular, it is shown that the V-A coupling gives identical results as the helicity imposition in the phenomenological theory. Further, when the allowed approximation is incorporated into the V-A coupling, the references of "Singlet" and "Triplet" radiations to the separate vector (Fermi) and pseudovector (Gamow-Teller) contributions are made explicit. (Dissertation Abstr.)

26385 REGGE POLES IN HIGH ENERGY PHOTOMESON PRODUCTION. Rodney Emerson Kreps. Thesis, Princeton, N. J., Princeton Univ., 1963. 57p.

The predictions of the Regge hypothesis are worked out in detail for pion photoproduction from nucleons. The amplitude is considered in the annihilation channel, and the angular momentum decomposition in this channel is worked out by imposing two-body unitarity relations. The unitarity relations are then solved by a N/D method and then formally extended to include inelastic processes. At this point the Regge hypothesis on the poles of the S-matrix is assumed, and the angular momentum sum is converted into an integral. The integration path is then deformed to give the usual representation in terms of the poles, and the high-energy limit (in the photoproduction channel) is taken. In this limit the specific energy dependence of the cross section is given, as are the necessary lab parameters for the limit to be applicable. (Dissertation Abstr.)

Field Theory and Quantum Mechanics

Refer to abstract 26303.

26386 (NP-13958) SISTEMY PO VNESHNEM POLE. (Systems in External Field). A. B. Migdal (U.S.S.R. Soviet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). 1964. 36p.

Systems without pair correlations were developed considering Green's field functions, equations for the vertex (renormalization), equations for vertices in homogeneous infinite systems (pulse concept), and equations for quasi-particle distribution functions in an external field. Systems with pair correlations were developed considering Green's functions for external fields (strong and weak), variations of Green's functions in the field (graphic concept), equations for the vertex (renormalization), ratios between T^{-} and T vertices, variations in external fields (equations for $\tau^{(1)}$ and $\tau^{(2)}$ vertices), equations for vertices in infinite systems (pulse concept), and equations for vertices in finite systems (λ concept). (R.V.J.)

26387 (ORNL-3582(p.41-5)) QUANTIZED SPACE-TIME. T. A. Welton (Oak Ridge National Lab., Tenn.).

A formalism has been discovered for the consistent introduction of a fundamental length into relativistic quantum mechanics. (auth)

26388 STUDY OF A GENERALIZATION IN EINSTEIN-SCHRÖDINGER RELATIVISTIC UNIFIED FIELD THEORY. Liane Bouche (Poincare Inst., Paris). Ann. Inst. Henri Poincare, 18: 1-7(1963). (In French)

It was hoped to derive the equations of motion of a charged particle by a method analogous to that used in the interior electromagnetic case of general relativity. An attempt was made to elaborate a theory of the Einstein-Tonnelat type such that the equations could be deduced from a variational principle, but by postulating a priori that the initial connection is to a null-torsion vector. The equations of interest are deduced by a variational principle from unified field theory. The problem of Cauchy is studied. The field equations are treated by an approximation method in order to put them into the form of the interior case of general relativity. It turns out that a Lorentz force does not appear in the approximate equations if the antisymmetric field equations are verifiable. The linear connection coefficients are calculated. (M.J.T.)

26389 SOME IDENTITIES IN GENERAL RELATIVITY AND IN UNIFIED FIELD THEORY. A. Papapetrou. Ann. Inst. Henri Poincare, 18: 99-108(1963). (In French)

It is shown that, along with the identities corresponding to the Lagrangian-invariance properties of a field theory, an analogous system of identities may be formed, corresponding to a tensor constructed using the fundamental magnitudes of the field. The cases of symmetric and asymmetric affine connections are considered. (M.J.T.)

26390 SOLUTION OF A FIELD THEORETICAL MODEL IN ONE SPACE-ONE TIME DIMENSION. Walter E. Thirring and J. E. Wess (Universität, Vienna). Ann. Phys. (N. Y.), 27: 331-7(May 1964).

A model of massless fermions interacting with massive vector particles in two dimensions is solved. The solutions are first given in terms of Green's functions and then in terms of operators which reproduce the Green's functions. The operators span a larger Hilbert space and it is shown that the field equations hold only in a subspace. The solution is also discussed in terms of Feynman diagrams. (auth)

26391 EQUATIONS OF MOTION IN THE THEORY OF GRAVITATIONAL PERTURBATIONS. Adolf Kuehnel (Karl-Marx Universität, Leipzig). Ann. Phys. (N. Y.), 28: 116-33 (June 5, 1964).

In the two lowest orders of the fast-motion approximation for gravitational perturbations, the equations of motion for a system of point particles are derived from the (slightly modified) equations of motion for a perfect compressible fluid by a transition from small drops to pointlike particles. In the first order equations the singular terms arising in the limit $l \to 0$ (l is the diameter of a drop), which do not cancel out because of the stability condition, are removed by a mass renormalization. Radiation damping terms occur like those in electrodynamics. In the second approximation two subtractions are needed: one for the mass and one for the coupling constant. The "damping terms" in the second order equation of motion are symmetric under time reversal. (auth)

26392 ON THE MULTIPOLE EXPANSION IN ELECTRODYNAMICS. R. Shail (Univ. of Liverpool). Can. J. Phys., 42: 1011-15(May 1964).

It is shown that the Goeppert-Mayer device of subtraction of a total time derivative from the Lagrangian may be used to obtain higher multipole couplings. A localized hydrogen atom is considered, and the system of atom plus radiation field is treated as a closed dynamical system. (M.J.T.)

26393 THE VAN ALPHEN-DE HAAS EFFECT FOR BOUND ELECTRONS. Wolfgang Kroll and Kai-Yuan Chung (National Taiwan Univ., Taipei). Chinese J. Phys. (Taiwan), 1: 49-58(Oct. 1963).

The partition function for bound electrons in a magnetic field is calculated by an approximation method. The magnetic susceptibility is then found in the usual manner. (auth)

26394 TYPE-N GRAVITATIONAL WAVES IN NON-EMPTY SPACE-TIME. J. Krishna Rao (Gujarat Univ., Ahmedabad, India). Current Sci. (India), 32: 350(Aug. 196

Three exact solutions of the Einstein-Rosen cylindrically symmetric space-time corresponding to the field equations of Lichnerowicz' total radiation were previously given. One of the solutions is shown to possess a Weyl tensor of type N and, therefore, to represent gravitational radiation in nonempty space-time. (D.C.W.)

26395 ENERGY OF THE SCHWARZSCHILD EXTERIOR FIELD. K. B. Shah (Physical Research Lab., Ahmedabad, India). Current Sci. (India), 32: 496(Nov. 1963).

Using a tetrad superpotential that is identical with the Einstein superpotential h_i^{kl}, the energy outside the Schwarzschild singularity was found to be nonzero. It is concluded that the gravitational field outside the material system associated with the field does possess gravitational energy. (D.C.W.)

26396 ELECTROMAGNETIC RADIATION FROM UNIFORMLY MOVING DIPOLES AND POINT CHARGES IN A GYRO-ELECTRIC-MAGNETIC MEDIUM. PART ONE. Musa Yildiz (Raytheon Co., Wayland, Mass. and General Applied Science Labs., Inc., Long Island, N. Y.). J. Electron. Control (1), 16: 361-79(Apr. 1964).

The monochromatic radiation from an oscillating dipole or a charge moving along the direction of an external magnetic field is investigated. It is found that, generally, several waves exist in the radiation zone, travelling in different directions with different anisotropic radial wave numbers. The anisotropy of gyro-electric-magnetic (gyrotropic) medium is characterized by the dyadic form of the permittivity ϵ and the permeability μ. For this general case, the complete expressions for the fields are evaluated by considering the motion of an oscillating dipole and a point charge, by employing an approach differing from that of previous investigators. (auth)

26397 THE CONVERGENCE OF AN APPROXIMATION USED IN THE RELATIVISTIC MASS-CENTER PROBLEM. Morris Weisfeld (Philco Corp., Palo Alto, Calif.). J. Math. Anal. Appl., 8: 282-6(Apr. 1964).

The solution of perturbation methods of the equation $d^2\mu/d\varphi^2 = U = 1 + \lambda U^2$ (where λ is very small), which arises in the consideration of the motion of a test particle about a mass center in general relativity, yields a power series in λ. The convergence of this series is studied, and sufficient conditions for convergence are obtained. The deviation from the Newtonian case ($\lambda = 0$) is estimated by summing the majorizing series. (D.C.W.)

26398 A NOTE ON THE USE OF WICK'S THEOREM. Alladi Ramakrishnan (RAND Corp., Santa Monica, Calif.), K. Venkatesan, and V. Devanathan. J. Math. Anal. Appl., 8: 345-9(Apr. 1964).

It is proved that if the concept of "typical sequence of events" used by Ramakrishnan is applied to Wick's procedure for reducing the s-matrix, then the same simplification of the proof of the equivalence of the Feynman and field theoretic formalisms of quantum mechanical collision processes is obtained that Ramakrishnan obtained by more complicated means. (D.C.W.)

26399 QUANTUM ELECTRODYNAMICS OF THE STIMULATED EMISSION OF RADIATION. [PART] I. R. M. Bevensee (Univ. of California, Berkeley). J. Math. Phys. (N. Y.), 5: 308-24(Mar. 1964).

The quantum electrodynamic formalism of Senitzky is developed so as to yield long-time differential equations for the time-average expectation values of electric field energy and excess molecular population in a system composed of one resonant cavity mode, two-level molecules, and a dissipation mechanism. The cavity-mode resonant frequency is essentially the mean molecular transition frequency of either a Gaussian or Lorentzian distribution of transition frequencies. The intermolecular and lattice T_1 and T_2 time constants are assumed to be much longer than the stimulated emission period. The field is coupled to either the electric or the magnetic dipole moments of the molecules. Senitzky's papers are summarized and the relevant expressions for the Heisenberg field and molecular operators are listed. Modified time-average expressions are obtained for the presence of a transient coherent driving field and perhaps an "off-resonance" molecular distribution of transition frequencies. Time averages of the derivatives of various terms in the expected field energy are compared to derivatives of time averages of those terms. Well-behaved differential equations are obtained for the time-average expectation values of field energy and molecular excess population, justified on a long-time basis by the application of an intermittent similarity transformation. A differential equation for the time-average dispersion (second moment) of electric field energy is obtained, which indicates that the relative dispersion tends to decrease during the pumping interval and increase back to the thermal value during the emission interval. Energy transfer from pumping field to molecules to the resonant field during the pumping interval is described qualitatively. The direct-product form for the density matrix $\rho = \rho$(field) $\times$ ρ(molecules) $\times$ ρ(dissipation mechanism) is justified by maximum-entropy inference. In conclusion, the equations of motion for the time-average expectation values of field energy and molecular population are interpreted so as to explain the envelope modulation of a solid-state laser beam during the emission period. (auth)

26400 SEGAL'S QUANTIZATION PROCEDURE. Reese T. Prosser (Massachusetts Inst. of Tech., Lexington). J. Math Phys. (N. Y.), 5: 701-7(June 1964).

The procedure proposed by I. E. Segal for the quantization of nonlinear problems of field theory is here applied to the one-dimensional oscillator. It is shown that for the linear oscillator Segal's procedure is equivalent to the canonical procedure, but that for the nonlinear oscillator the two procedures lead to quite different results. The differences are reflected in the equations of motion, the energy spectra, and the scattering cross sections. (auth)

26401 CONVERGENT PERTURBATION EXPANSIONS FOR CERTAIN WAVE OPERATORS. Reese T. Prosser (Massachusetts Inst. of Tech., Lexington). J. Math. Phys. (N. Y.), 5: 708-13(June 1964).

The validity of Dyson's perturbation expansion for the Møller wave operators under suitable restrictive assumptions on the interaction potential is rigorously established. (auth)

26402 THE NECESSARY AND SUFFICIENT CONDITION IN TERMS OF WIGHTMAN FUNCTIONS FOR A FIELD TO BE A GENERALIZED FREE FIELD. W. Garczynski (McGill Univ., Montreal). J. Math. Phys. (N. Y.), 5: 714-19(June 1964).

The description of the generalized free field in terms of the Wightman functions is given. The necessary and sufficient condition for a field to be a generalized free field is established. (auth)

26403 ON DIRAC'S WAVE EQUATION IN A GRAVITATIONAL FIELD. Asher Peres (Israel Inst. of Tech., Haifa). J. Math Phys., (N. Y.), 5: 720-1(June 1964).

The Dirac equation is investigated in the combined electric and gravitational field of a point charge in general relativity. The wavefunctions are weakly singular at the origin, but still normalizable for a continuous range of the

energy. The hamiltonian, however, is not self-adjoint over the manifold of its own eigenstates, though it can be made self-adjoint by a suitable choice of its domain of definition. The theory, however, is unable to decide how the hamiltonian should be defined and what are the bound states. (auth)

26404 PROPERTIES OF A CLASS OF NONLOCAL SOLVABLE INTERACTIONS. G. C. Ghirardi and A. Rimini (Università, Trieste, Italy). J. Math. Phys. (N. Y.), 5: 722-8(June 1964).

A generalization of factorable interactions is taken into account. The direct and inverse problems for the relative Schrödinger equation are investigated, and they turn out to be workable. It is shown that such interactions can produce several bound states. The solution of the direct problem is given. A class of interactions of the considered type is constructed which produces an arbitrarily assigned finite set of bound states. (auth)

26405 QUANTUM KINETIC EQUATIONS FOR ELECTRONS IN A PERIODIC SYSTEM. Amiram Ron (Univ. of California, San Diego, La Jolla). J. Math. Phys. (N. Y.), 5: 748-55(June 1964).

The approach to equilibrium of a system of electrons in a periodic system is studied by deriving a kinetic equation in the self-consistent field approximation. The derivation based on the introduction of an hierarchy of equations for the s-body density matrices and employing a truncation scheme, valid in the self-consistent field approximation. The irreversibility is introduced by the adiabatic hypothesis of Bogoliubov. The kinetic equation takes proper account of the collective aspects of the electron system and includes the dynamic shielding. (auth)

26406 SOME DYNAMICAL PROPERTIES OF AN IMPURITY IN THE HARD-SPHERE BOSE GAS. Toshio Soda (Univ. of Chicago). J. Math. Phys. (N. Y.), 5: 769-74 (June 1964).

The dynamical properties of an impurity in the hard-sphere Bose gas are investigated by extending the pseudopotential method and hamiltonian of previous work. The interaction potential between two impurities is calculated up to one quasiparticle exchange and is shown to have a Yukawa form of attraction with a range of $(16\pi\rho a)^{-\frac{1}{2}}$ in addition to the hard-core interaction at the origin (ρ and a are the density of the boson gas and hard-core diameter of the boson, respectively). Necessary conditions for impurities to have a bound state are also obtained. It is found that the mass of the impurity must be greater than approximately nine times the boson mass, and the density of the boson gas must lie in some range with a maximum and minimum. Then the differential cross section for Compton-type scattering and one quasiparticle production on an impurity are calculated. The Cherenkov radiation of sound quanta is studied when the impurity is traveling very fast in the hard-sphere Bose gas. It is found that there is no radiation unless the velocity v of the impurity is faster than $[k^2 + (16\pi\rho a)]^{\frac{1}{2}}$ and the radiation has a maximum for the angle θ_0 such that $\cos\theta_0 = (k^2 + 16\pi\rho a)^{\frac{1}{2}}/v$. The cross section for Cherenkov radiation is also calculated (k is the momentum of the quasiparticle emitted in the Cherenkov radiation). (auth)

26407 SINGULAR POTENTIALS AND PERATIZATION. PART II. A. Pais (Rockefeller Inst., New York) and Tai Tsun Wu. J. Math. Phys. (N. Y.), 5: 799-804(June 1964).

In a field theory with more than one unrenormalizable interaction (like the W theory with weak and electromagnetic coupling), the important problem arises of resumming multiple series of individually divergent terms. In order to get a first insight in the new questions that arise for multiple as compared to single series, the analogous question for a superposition of two singular potentials is studied using a family of exactly soluble cases. The question of whether one can expand resummed series for the zero-energy scattering amplitude in powers of one coupling constant with coefficients depending on the other is considered. The answer depends both on the relative magnitude of the coupling constants and on the relative degree of singularity of the interactions. Depending on these two conditions one finds three regimes, one where a convergent power expansion holds, another where an asymptotic expansion obtains, and a third where it is impossible to expand in powers of either single constant separately. It is conjectured that a similar situation will be true in a field theory with leading power singularities only (and no logarithmic ones), if such a theory has meaning. (auth)

26408 EFFECT OF THE COULOMB INTERACTION ON ULTRASONIC ATTENUATION. Yukio Osaka (Tohoku Univ., Sendai). J. Phys. Soc. Japan, 19: 436-48(Apr. 1964).

The ultrasonic attenuation due to impurity scattering in a degenerate interacting electron gas is calculated. Contributions from diagrams of all possible combinations of the ladder interaction and exchange self-energy are included. The result is essentially the same as that of the previous work in which the Coulomb correlation was neglected. (auth)

26409 A POSSIBLE GENERALIZATION OF QUANTUM ELECTRODYNAMICS. O. Hellman (Univ. of Turku, Finland). Nucl. Phys., 52: 609-29(Apr. 1964).

The formalism of quantum electrodynamics is generalized to a formalism in which the differential equations are replaced by covariant functional equations, a kind of difference equations. The expressions contain the dimensionless constant $\beta = mcl_0/\hbar$, where l_0 is a length which is introduced into the equations by the process of generalization. For $\beta > 1$ all free field solutions of the generalized Dirac equation, a denumerably infinite family of Dirac fields with complex masses, have a finite lifetime. For $\beta < 1$ the free field solutions will include, in addition to the above decaying Dirac fields, two stationary waves—those of a Dirac equation with mass $m\ln(1-\beta)^{-1/\beta}$. The ordinary perturbation method converges for $\beta > 1$ and also for $\beta < 1$, provided that the stationary waves are first excluded. The problem of finding the total energy of the system in the case of a value of $\beta = \beta_1 < 1$ may be solved by first going over to a value $\beta_2 > 1$ by applying the now convergent perturbation method for the equations with $\beta = \beta_2$ and then by letting $\beta_2 \rightarrow \beta_1$ in the expression for the energy. (auth)

26410 QUASI-OPTICAL POTENTIAL IN QUANTUM FIELD THEORY. Nguyen Van-hieu and R. N. Faustov (Joint Inst. for Nuclear Research, Dubna, USSR). Nucl. Phys., 53: 337-44(Apr. 1964).

The construction of potentials dependent on energy in the model of a quantum field theory with scalar particles is considered according to perturbation theory. The method of the two-time Green functions and that of the scattering amplitude on the mass-shell are used. The calculated corrections to the Coulomb energy levels coincide in the two methods. However, the second method is more effective due to the locality and the analyticity of the potential. (auth)

26411 ON FLUCTUATIONS IN STATISTICAL MECHANICS. R. C. T. da Costa (Universidade de Sao Paulo, Brazil). Nuovo Cimento (10), 32: 654-78(May 1, 1964).

Closed formulas for small fluctuations are obtained for the case of macroscopic quantities which can be written as

an integral in μ-space (one-particle phase-space) of the form $\int\chi(x,p,\rho(x,p))dxdp$, where χ is an arbitrary function of co-ordinates, momentum, and of particle density $\rho(x,p)$. The second-order approximation of Einstein's expression is employed. Comparison is made with the fluctuations in energy and occupation numbers obtained by Darwin-Fowler technique and from the canonical and grand canonical ensembles. The physical meaning of the results is discussed. (auth)

26412 A CLASS OF SOLVABLE POTENTIALS. A. K. Bose (Univ. of Montreal). Nuovo Cimento (10), 32: 679-88 (May 1, 1964).

The problem of the construction of solvable one-variable Schrödinger potentials is formulated. A class of simple potentials for which the Schrödinger equation can be solved in terms of special functions of physics is constructed. (auth)

26413 BOUND STATES AND RENORMALIZATION PROPERTIES. L. Bertocchi (Universita, Bologna), S. Fubini, and G. Furlan. Nuovo Cimento (10), 32: 745-56(May 1, 1964).

The connection between the bound-state problem and the renormalizability of the theory is discussed in both potential scattering and quantum field theory. In particular, it is shown that a meaning can also be given to the bound-state condition in the framework of perturbation theory, if all the terms of the series are cut-off dependent. (auth)

26414 ON THE DESCRIPTION OF BOUND STATES IN QUANTUM FIELD THEORY. P. Olesen (Universitetets Institut for Teoretisk Fysik, Copenhagen). Phys. Letters, 9: 277-8(Apr. 15, 1964).

A "self-consistent" field theory, where the different particles are considered as bound states of each other, was proposed by Salam; in it, a bound state is obtained by setting the renormalization constants Z_i equal to zero. For the correct behavior on the mass shell, the self mass δm must vanish. It is shown that if $Z_i = 0$ then $\delta m \neq 0$ in a scalar as well as a spinor theory, in contradiction to the "self-consistency" of Salam's theory. (M.J.T.)

26415 SCATTERING FORMALISM FOR SINGULAR POTENTIAL THEORY. A. Pais (Rockefeller Inst., New York) and Tai Tsun Wu. Phys. Rev., 134: B1303-7 (June 22, 1964).

When using power-series expansions in the coupling constant(s) for the computation of scattering amplitudes in singular potential theory, it is necessary to introduce some cutoff in order to avoid divergences of the individual terms in this series. In earlier work this was done by cutting off the potential. It is shown that the general scattering formalism actually contains an intrinsic limiting operation which makes it unnecessary to introduce a cutoff as an extraneous computational device. For regular potentials one tacitly and justifiedly exchanges this operation with another step in the derivations. It is not clear whether such a built-in cutoff procedure also exists in unrenormalizable field theory. (auth)

26416 FREE-SPACE BOUNDED PLANE-WAVE SOLUTIONS TO THE MAXWELL-LORENTZ EQUATIONS. Donovan V. Geppert (Stanford Research Inst., Menlo Park, Calif.). Phys. Rev., 134: B1407-9(June 22, 1964).

A relativistic fluid concept of electric charge is introduced, from which free-space laterally-bounded plane-wave solutions to the inhomogeneous Maxwell-Lorentz equations can be obtained in harmony with the particle-like nature of the radiation field. (auth)

26417 TIME SYMMETRY IN THE QUANTUM PROCESS OF MEASUREMENT. Yakir Aharonov, Peter G. Bergmann, and Joel L. Lebowitz (Yeshiva Univ., New York). Phys. Rev., 134: B1410-16(June 22, 1964).

We examine the assertion that the reduction of the wave packet, implicit in the quantum theory of measurement introduces into the foundations of quantum physics a time-asymmetric element, which in turn leads to irreversibility. It is argued that this time asymmetry is actually related to the manner in which statistical ensembles are constructed. If an ensemble is constructed time symmetrically by using both initial and final states of the system to delimit the sample, then the resulting probability distribution turns out to be time symmetric as well. The conventional expressions for prediction as well as those for retrodiction may be recovered from the time-symmetric expressions formally by separating the final (or the initial) selection procedure from the measurements under consideration by sequences of coherence destroying manipulations. One can proceed from this situation, which resembles prediction, to true prediction (which does not involve any postselection) by adding to the time-symmetric theory a postulate which asserts that ensembles with unambiguous probability distributions may be constructed on the basis of preselection only. If the validity of this postulate and the falsity of its time reverse result from the macroscopic irreversibility of the universe as a whole, then the basic laws of quantum physics, including those referring to measurements, are as completely time symmetric as the laws of classical physics. As a by-product of the analysis, it is found that during the time interval between two noncommuting observations, one may assign to a system the quantum state corresponding to the observation that follows with as much justification as one assigns, ordinarily, the state corresponding to the preceding measurement. (auth)

26418 ANSWER TO FOCK CONCERNING THE TIME ENERGY INDETERMINACY RELATION. Y. Aharonov and D. Bohm (Yeshiva Univ., New York and Birkbeck Coll., London). Phys. Rev., 134: B1417-18(June 22, 1964).

An answer is given to a recent criticism by Fock (NSA 16: 23249), concerning the paper "Time in the Quantum Theory and the Uncertainty Relation for Time and Energy." It is proved that Fock's criticism is wrong, and that the previous conclusion that energy can be measured in an arbitrarily short period of time is valid. (auth)

26419 HIGH-INTENSITY QUANTUM ELECTRODYNAMICS. I. INTENSITY DEPENDENCES FOR FEYNMAN DIAGRAMS. L. M. Frantz (TRW Space Tech. Labs, Redondo Beach, Calif.). Phys. Rev., 134: B1419-29(June 22, 1964).

The prescriptions for evaluating Feynman diagrams in quantum electrodynamics are extended to the regime of incident photon beams having nonzero intensity. This is done both for the time-dependent formulation of the S-matrix perturbation theory, and for the stationary-state Brillouin-Wigner perturbation development. The results are applicable to a theory of any boson field, as they depend only on the Bose-Einstein commutation properties of the field operators; no restrictions are made on the nature of the interaction hamiltonian. It is shown that, as far as radiative corrections are concerned, the presence of the incident beam is to be ignored; it is to be manifested by a weighting factor which depends on the count of only external photon lines connected to the scatterer line. The distribution of the incident photons over modes of the radiation

field is completely arbitrary, and the results are valid to all orders in the perturbation theory. (auth)

26420 COMMUTATORS ON CHARACTERISTIC SURFACES. Arthur Komar (Yeshiva Univ., New York). Phys. Rev., 134: B1430-?(June 22, 1964).

The Lagrangian formalism is employed to derive the commutation relations on null surfaces for relativistic field theories. The theories treated are the Klein-Gordon field, the Maxwell field, the linearized gravitation theory, and the general theory of relativity. Special attention is paid to the treatment of null surfaces at infinity, on which the commutation relations for the "news function," which represents the independent radiation modes of the field were obtained. For the general theory of relativity, the methods seem appropriate only when the theory is truncated by excluding solutions that are not asymptotically flat in the sense of Penrose. (auth)

26421 SIMPLE BINARY COLLISION MODEL FOR VAN HOVE'S $G_s(r,t)$. Mark Nelkin and Ajoy Ghatak (Cornell Univ., Ithaca, N. Y.). Phys. Rev., 135: A4-9(July 6, 1964).

It is noted that the Van Hove self-correlation function $G_s(r,t)$ for a dilute fluid is determined by a linearized Boltzmann equation identical to that occurring in the theory of neutron diffusion. A simple model for the collision integral, in which a molecule emerges from a collision with a Maxwellian distribution, allows some interesting analytic results to be obtained. The double Fourier transform $S_s(\kappa,\omega)$, of $G_s(r,t)$ is expressible in terms of the probability integral for complex arguments. Since $S_s(\kappa,\omega)$ is directly proportional to the Mössbauer line shape, the transition of the line shape from Doppler broadening to simple diffusion broadening is explicitly exhibited as a function of momentum transfer. The spatial moments of $G_s(r,t)$ are calculated as a function of time. The model used gives the same mean-square displacement as does the Langevin equation. The resulting $G_s(r,t)$ is not, however, Gaussian. The non-Gaussian effects lead to an appreciable narrowing of $S_s(\kappa,\omega)$ for intermediate values of κ. (auth)

26422 MAGNETIC RESONANCE WITH LARGE ANGULAR MOMENTUM. J. W. Cederberg and N. F. Ramsey (Harvard Univ., Cambridge, Mass.). Phys. Rev., 135: A39-43(July 6, 1964).

Multiple quantum transitions present in molecular-beam magnetic resonance of molecules of high rotational angular momentum are treated in terms of a purely classical model. The probability of a change $(\Delta m_J/J)$ in rotational magnetic quantum number per unit angular momentum is shown to be given by $P(\Delta m_J/J) = 1/[4 \sin(\frac{1}{2}\epsilon)]$ if $|\Delta m_J/J| < 2 \sin(\frac{1}{2}\epsilon)$ and $P(\Delta m_J/J) = 0$ if $|\Delta m_J/J| > 2 \sin(\frac{1}{2}\epsilon)$, where $P(\Delta m_J/J)\, d(\Delta m_J/J)$ is the fraction of molecules for which this change lies between $\Delta m_J/J$ and $\Delta m_J/J + d(\Delta m_J/J)$, and ϵ is the angle which the angular momentum makes with the magnetic field after the transition for a molecule whose angular momentum is initially along the field. The transition probability of a spin-$\frac{1}{2}$ particle under the same conditions is $\sin^2(\frac{1}{2}\epsilon)$. This probability is weighted according to the probability of detecting a transition with a change in magnetic moment of $\mu_J \Delta m_J$ and averaged over the thermal distributions of J and V to give a theoretical line shape. The theory is applied to rotational magnetic moments of molecules. The calculated line shape is shown to agree reasonably well with an experimental curve of the rotational magnetic-moment resonance of the molecule OCS. (auth)

26423 INTERACTION OF VERY INTENSE RADIATION FIELDS WITH ATOMIC SYSTEMS. Oldwig von Roos (California Inst. of Tech., Pasadena). Phys. Rev., 135: A43-50 (July 6, 1964).

A theory treating radiation processes involving a large number of photons in first- or second-order perturbation theory is developed. The theory is applied to the interaction of an atomic electron with a very intense linearly polarized laser beam. It is found that induced radiation will occur at all harmonics $n\omega_0$ of the fundamental laser frequency ω_0. The intensity distribution of this radiation is symmetric about the axis of polarization of the primary beam and is peaked at an angle of about 45° with respect to direction of propagation of the secondary radiation and the polarization of the incident radiation for the first few modes. This angle markedly shifts toward 0° for increasing n (higher harmonics). The transition probabilities are high enough to make the effect readily observable. (auth)

26424 GREEN'S FUNCTION APPROACH TO EXCITON-PHONON INTERACTIONS. Andris Suna (Princeton Univ., N. J.). Phys. Rev., 135: A111-23(July 6, 1964).

The system of a tightly bound exciton which is weakly coupled to phonons is treated by means of many-body Green's functions. Relevance of the formalism for the calculation of absorption and emission spectra, quasiparticle properties, lattice distortion, and exciton propagation is established. A variational technique is found useful for deriving formal relationships. Evaluations are carried out for an approximate Hamiltonian representing excitons in a one-dimensional lattice; both Einstein-model phonons and one-dimensional acoustic phonons are investigated. Approximations include a one-phonon approximation and, for many-phonon processes, the replacement of the exciton-phonon vertex function Γ by unity. The relation of these approximations to perturbation theory is assessed in specific cases. Finite-temperature calculations performed apply to excitons whose energies are large compared to κT. Among the results is the conclusion that the interacting exciton is not merely renormalized; instead, as in the case of electron-phonon interactions, the spectrum of excitations includes many diverse quasiparticle modes and other complex structures. (auth)

26425 QUANTUM THEORY OF INTERFERENCE OF LIGHT FROM TWO LASERS. T. F. Jordan and F. Ghielmetti (Universitat, Bern). Phys. Rev. Letters, 12: 607-9 (June 1, 1964).

It is suggested that the interference phenomena observed in the superposition of two independent laser beams could be due mainly to an interference term in the average intensity—in close analogy to the explanation in terms of classical fields; this supposition is based on the hypothesis that the average of the field is not zero for induced laser radiation as it is for spontaneous thermal radiation. The light from the two lasers would possess a coherence depending only on the magnitudes of the expectation values. (M.J.T.)

26426 COHERENT PAIRING OF THE SECOND KIND FOR STRONGLY INTERACTING FERMIONS. Morrel H. Cohen (Univ. of Chicago). Phys. Rev. Letters, 12: 664-6 (June 15, 1964).

A radial dependence of the s-wave pairing leading to a nonsuperconducting state is proposed. Some properties of such a state are given. The collective resonance observed in potassium is taken as evidence for the existence of pairing of the second kind in that metal. (D.C.W.)

26427 PATH INTEGRALS IN POLAR CO-ORDINATES. S. F. Edwards and Y. V. Gulyaev (Univ. of Manchester, Eng.). Proc. Roy. Soc. (London), Ser. A, 279: 229-35 (May 26, 1964).

Functional integrals of the usual diffusion type in x(t), y(t), z(t) are discussed, when transformed into polar coordinates r(t), φ(t), ϑ(t). It is found that the functional integration can be performed directly but the limiting process of taking $\Delta t \to dt$ is more complicated than that encountered in normal integral and differential calculus. In particular, terms of order $(\Delta t)^2$ can not be neglected relative to terms of order (Δt). (auth)

26428 AN APPROACH TO THE FORMULATION OF QUANTUM ELECTRODYNAMICS WITHOUT USE OF INDEFINITE METRIC. Shigeo Sato (Rakkyo Univ., Tokyo). Progr. Theoret. Phys. (Kyoto), 31: 256-68(Feb. 1964).

Formulation of the quantum electrodynamics without using indefinite metric is investigated. Calculations are made to the third order in the perturbation expansion. As the wave function of free photons, a representation is adopted in which only the transverse components take part. The second quantization is performed by Fock-Cook-Friedrich's method. The first order interaction Hamiltonian is determined to correspond to that of the transverse photon in the conventional field theory. The Coulomb interaction is introduced as an additional second order term which is necessitated by the covariance requirement of the theory. As for the second order divergences which correspond to the self-energy of the photon and to the renormalization of the electron wave function in the conventional theory, it is shown that the counter terms are necessarily introduced from the requirement of covariance only. The divergence corresponding to the renormalization of the photon wave function does not appear. To treat the divergence of the self-energy of the electron, an additional counter term must be added, as is done in the usual theory. As for the third order vertex part, it is shown that the correct value of the anomalous magnetic moment is obtained, although the divergent part contains a new term. (auth)

26429 QUANTIZED FREE UNSTABLE PARTICLE FIELD. Hideji Kita and Yōko Kawai (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 31: 269-99(Feb. 1964).

A formulation of the asymptotic, quantized field of unstable particles without spin and charge is presented. (D.C.W.)

26430 REGULAR PERTURBATION AND ASYMPTOTIC LIMITS OF OPERATORS IN FIXED-SOURCE THEORY. Nobumichi Mugibayashi and Yusuke Kato (Kobe Univ., Japan). Progr. Theoret. Phys. (Kyoto), 31: 300-10 (Feb. 1964).

Within the theory of regular perturbation, the restriction on the source function is slightly relaxed, so that the theory may include cases in which the interaction part of Hamiltonian not only has no dense domain common with the free part, but is also never defined in a Hilbert space. A smallness condition of the interaction part expressed in terms of symmetric quadratic forms ensures the total Hamiltonian to be uniquely determined as a self-adjoint operator. All the results concerning the strong asymptotic limits of operators which have been established previously for more restrictive source functions are retained. (auth)

26431 ON THE COMMUTATION RELATION FOR THE CANONICAL ENERGY DENSITY. Toshiei Kimura (Hiroshima Univ.). Progr. Theoret. Phys. (Kyoto), 31: 311-21 (Feb. 1964).

The interaction Hamiltonian in the interaction representation for an arbitrary spin field coupled to the external gravitational field is obtained by using an extension of Yang-Feldman's method. The equal time commutator for the canonical energy density is derived directly from the integrability condition of the Schrödinger equation in the interaction representation. It is shown that the presence of ordinary interactions among fields does not drastically alter the form of the commutator for free fields. The relation between the present method and Schwinger's method based on the extended conservation law is also discussed. (auth)

26432 MATHEMATICAL PROBLEMS IN QUANTUM THEORY OF SCATTERING FOR THREE PARTICLE SYSTEMS. L. D. Faddeev. Tr. Mat. Inst., Akad. Nauk SSSR, 69: 3-122(1963). (In Russian)

Functions were developed for continuous spectra in perturbation theory considering a three-particle system in a reciprocal paired action (the simplest system) in which the induced perturbations affect the continuous spectrum of the energy operator. An accurate resolution is given in terms of Gilbert space operators. Basic conditions are given for all potentials, and energy operator resolutions are investigated for two and three particles. Integral operators are introduced as resolved terms, and integral equations are developed in order to estimate the operator nuclei and to find the singularities of these nuclei when Z is variable in the vicinity of a real axis. The results are applied to prove the theorem of eigenfunction expansion in order to justify the foundation for the scattering problem and unique scattering operators. Supplementary data are given for some properties of functions satisfying Holder boundary conditions and for singular integrals for these functions. (R.V.J.)

26433 QUANTUM THEORY OF TIME MEASUREMENT. [PART] II. Folker Engelmann and Eugen Fick (Euratom-CNEN, Rome and Technische Hochschule, Munich). Z. Physik, 178: 551-62(1964). (In German)

The possibility is discussed that observable time may be described by a hermitian operator, which is maximal but not hypermaximal. The special example considered regards systems having a continuous energy spectrum with a lower bound. It is shown that in this case physical states can be constructed that are elements of the domain of definition of the time operator and which approximate its eigenfunctions with arbitrary accuracy. Hence time is observable within the limits of the precision of real measuring devices. The situation is thus very similar to that of physical quantities which correspond to hypermaximal operators with continuous spectrum. This suggests that V. Neumann's axiom stating that there is a one-to-one connection between observables and the hypermaximal operators of the Hilbert space of states, is too restrictive. (auth)

26434 EIGENFUNCTION SOLUTIONS OF WAVE EQUATIONS FOR HETEROGENEOUS LAYERS. T. I. Kuznetsova (Lebedev Inst. of Physics, Moscow). Zh. Tekhn. Fiz., 34: 419-25(Mar. 1964). (In Russian)

A plane-parallel model of a layer with a heterogeneous imaginary dielectric penetrability was used for calculating axial and nonaxial oscillations in a gaseous quantum generator. (tr-auth)

26435 ADVANCES IN QUANTUM ELECTRONICS. Jay R. Singer, ed. New York, Columbia University Press, 1961. 655p.

Sixty-nine papers on the generation, detection, and amplification of coherent electromagnetic radiation (primarily optical and infrared) with wavelengths of a few millimeters are included. Devices, materials, and theory are all considered. Optical masers, optical pumping, photon-molecule interactions, resonance phenomena, microwave transitions, and maser application to communications are among the specific topics covered. (D.C.W.)

26436 AN INVESTIGATION OF THE BOGULIUBOV TRANSFORMATION APPLIED TO BOSE-EINSTEIN PARTICLES. William H. Bassichis. Thesis, Cleveland, Case Inst. of Tech., 1963. 61p.

The method developed by Boguliubov for an imperfect Bose-Einstein gas is generalized in order to permit examination of a mixture of an arbitrary number of different species of bosons. The generalized method involves diagonalization of a matrix which has a Hermitian-like property by a unitary-like transformation in a space with an indefinite metric. When a neutral mixture of two types of charged bosons is examined it is found that two types of elementary excitations exist; one having the energy-momentum dispersion relation associated with plasma oscillations and another having the energy-momentum relationship characteristic of a free particle with a modified mass. Calculations show that the plasma type excitation consists of an oscillation in charge density while the free-particle-like excitation consists of an oscillation in mass density. A simple model of a boson system is considered in which there are only three states available to each boson. The exact Schrödinger equation is solved numerically. The ground state energy is also found by the Boguliubov method and an approximate numerical method. The results of all calculations converge to the crude Boguliubov result when the number of particles in the system approaches infinity. (Dissertation Abstr.)

26437 RENORMALIZATION IN THE STOCHASTIC THEORY. Raymond Joseph Genolio. Thesis, University Park, N. Mex., New Mexico State Univ., 1963. 86p.

In stochastic field theory, which has no ultraviolet divergences, renormalization is used to construct an S-matrix that leaves single particle states unchanged or steady. A detailed renormalization program is carried out for stochastic quantum electrodynamics. First, conditions for steadiness are established and a renormalized S-matrix that satisfies steadiness is defined. The renormalized S-matrix is then used to determine the renormalized interaction Lagrangian. Renormalization parameters occurring in the renormalized interaction Lagrangian turn out in general to be momentum dependent, finite and not scalar. These reduce to finite renormalization constants in the low energy limit. Renormalization constants including the electromagnetic mass of the electron and the bare mass of the photon are calculated to order $\alpha = 1/137$ using a fundamental length determined from the proton-neutron mass difference. Lowest order approximations of the proton magnetic moment and the electromagnetic mass differences within isotopic multiplets are also made. It is concluded from these calculations that the renormalization associated with the electromagnetic interaction is weak. The common assumption that the photon self-energy is gauge invariant is shown to be incorrect; however, it is also shown that the deviation from the gauge invariant form can be removed by renormalization. (Dissertation Abstr.)

26438 GROUP THEORY AND QUANTUM MECHANICS. Michael Tinkham. International Series in Pure and Applied Physics. New York, McGraw-Hill Book Company, 1964. 351p. $11.50.

The elements of group theory most relevant to physics are reviewed, together with applications illustrating its usefulness. The formal theory of finite groups and their representations is developed, and physical applications of group theory are illustrated. The theory of systems with full rotational symmetry is then considered. Finally, a variety of problems in the quantum theory of atoms, molecules, and solids is treated, with emphasis on the utility of group theory. (D.C.W.)

Geophysics

Refer to abstract 26794.

26439 ON EXTERNAL RADIO EMISSION FROM THE EARTH'S OUTER ATMOSPHERE. G. R. A. Ellis (Univ. of Tasmania, Hobart). Australian J. Phys., 17: 63-74 (Mar. 1964).

The possibility is considered that cyclotron radiation, generated by fast bunched electrons in the Earth's outer atmosphere, may be observable outside the geomagnetic field. It is shown that the intensity and other properties of such external radiation may be deduced from the known characteristics of v-l-f hooks. It appears likely that the radiation will occur as short bursts in the frequency range from 200 to 1000 kc. The total radiated power may be from 1 to 1000 w, depending on the electron energy. (auth)

26440 THE CORRELATION BETWEEN THE OCCURRENCE OF SPORADIC-E AND THE HORIZONTAL COMPONENT OF THE EARTH'S MAGNETIC FIELD. L. H. Heisler (Univ. of Sydney) and J. D. Whitehead. J. Atmospheric Terrest. Phys., 26: 437-44(Apr. 1964).

A consideration of IGY and previous data on the occurrence of spordic E in the temperate zones supports the authors' previous conclusion that the occurrence of sporadic E is correlated principally with the horizontal component of the earth's magnetic field. The analysis also suggests that temperate zone spordic E tends to occur more frequently at high sunspot number and also occurs equally over land and sea. These suggestions disagree with the conclusions reached by other workers. (auth)

26441 EFFECT OF MAGNETIC ACTIVITY ON DRIFT AND ANISOTROPY OF THE E- AND F-REGION IRREGULARITIES. P. Balarama Rao and B. Ramachandra Rao (Andhra Univ., Waltair, India). J. Atmospheric Terrest. Phys., 26: 445-56(Apr. 1964).

The results of a correlation analysis of fading records taken during magnetically disturbed conditions for the E- and the F-region reflections are presented. The results are compared with those reported by Rao for magnetically quiet conditions. Diurnal curves for various parameters are presented along with that of the magnetic K index with a view to studying the variation in relation to the magnetic activity. The relation between the drift speeds at the E- and F-region levels and the magnetic K index was also studied by means of correlation coefficients using a large number of observations taken over magnetically quiet as well as disturbed conditions. The effect of magnetic activity on various parameters observed at this low latitude station are discussed in the light of the results reported from a similar study at Cambridge. (auth)

26442 THE INDUCTION OF ELECTRIC CURRENTS IN AN ANISOTROPIC IONOSPHERE WITH A BELT OF HIGH CONDUCTIVITY RUNNING ALONG THE EQUATOR. A. A. Ashour (Cairo Univ.) and V. C. A. Ferraro. J. Atmospheric Terrest. Phys., 26: 509-23(Apr. 1964).

The currents induced in an anisotropic ionospheric shell with a belt of high conductivity running parallel to the equator, by sudden external field changes are investigated. The implications for sudden commencements of magnetic storms, particularly, are considered. (D.C.W.)

26443 A NEW METHOD FOR ESTIMATING LOSS AND DRIFT TERMS IN THE IONOSPHERIC F-REGION. A. P. Mitra, B. C. Narasinga Rao, and K. K. Mahajan (National Physical Lab., New Delhi, India). J. Atmospheric Terrest. Phys., 26: 525-30(Apr. 1964).

A method is presented by which the terms in the con-

tinuity equation can be separated with the least amount of assumption. The method gives realistic estimates of the coefficient of attachment and the vertical ionic drift. (D.C.W.)

26444 A STUDY OF CHARGED PARTICLES IN THE EARTH'S OUTER RADIATION ZONE WITH EXPLORER 14. L. A. Frank, J. A. Van Allen, and H. K. Hills (State Univ. of Iowa, Iowa City). J. Geophys. Res., 69: 2171-91(June 1, 1964).

The results of a study of the intensities of electrons and protons near the equatorial plane in the outer radiation zone are presented. Data were obtained with Explorer 14 from October 1962 through February 1963. The radial distribution of absolute intensities of electrons and protons and the time variations of the energy spectrum and radial distribution of electrons, particularly, were studied. Artificial radiation belts from Soviet nuclear explosions in October and November 1962 were also detected; their time decays are plotted. (D.C.W.)

26445 ON THE CONTRIBUTION OF SOLAR-FLARE ALPHA PARTICLES TO POLAR CAP ABSORPTION EVENTS. R. A. Weir and R. R. Brown (Univ. of California, Berkeley). J. Geophys. Res., 69: 2193-8(June 1, 1964).

A series of calculations were performed to determine the relative importance of ionization from solar-flare alpha particles to polar cap absorption events. The exponential rigidity spectrums for solar-flare radiation discussed by Freier were used. To illustrate the actual magnitudes involved, typical fluxes, rigidity spectrums, and proton-α particle ratios from major polar cap events were used. The electron production rates, electron densities, and specific absorption as a function of altitude for a proton-α particle ratio of unity are presented for a location with cutoff rigidity $P_c = 470$ Mv. These results indicate that alpha particles contribute significantly, producing as much as 75% of the ionospheric absorption when the proton-α-particle ratio is unity. (auth)

26446 NEUTRON LEAKAGE FLUX FROM INTERACTIONS OF SOLAR PROTONS IN THE ATMOSPHERE. R. E. Lingenfelter and E. J. Flamm (Univ. of California, Los Angeles). J. Geophys. Res., 69: 2199-2207(June 1, 1964).

In a previous calculation the equilibrium neutron distribution in the atmosphere produced by interactions of solar protons was derived by a multigroup diffusion code. These calculations are now extended to include the neutron leakage flux up to 10 Mev as a function of energy and angle. Results are presented as a function of the characteristic rigidity and of geomagnetic cutoff rigidity to facilitate comparison with experimental data. Both the calculated neutron albedo and the equilibrium flux within the atmosphere agree with available measurements within the uncertainties of the data. (auth)

26447 SUDDEN IMPULSES IN THE MAGNETOSPHERE OBSERVED BY EXPLORER 12. Atsuhiro Nishida (Univ. of Chicago) and Laurence J. Cahill, Jr. J. Geophys. Res., 69: 2243-55(June 1, 1964).

Explorer 12 magnetic data show that a positive sudden impulse on the ground is accompanied by an increase in the field strength everywhere within the magnetosphere. Similarly, a negative sudden impulse on the ground is associated with a decrease in the field strength in the magnetosphere. Evidence is also found that the magnetospheric boundary moves outward at the time of a negative sudden impulse. The rise, and fall, time of a sudden impulse is the same everywhere in the magnetosphere (including that portion close to the boundary) and on the ground. Hence this time can be interpreted as the time in which the compression or the expansion of the magnetosphere takes place. The speed of propagation of the field variations through the magnetosphere seems to be close to the hydromagnetic wave speed. The magnitude of a sudden impulse at the satellite level relative to that on the ground is better explained by a magnetospheric model with a curved boundary than by an image dipole model. (auth)

26448 LOW-LATITUDE OBSERVATIONS OF FINE-STRUCTURED HYDROMAGNETIC EMISSIONS. Lee Tepley (Lockheed Missiles and Space Co., Palo Alto, Calif.). J. Geophys. Res., 69: 2273-90(June 1, 1964).

The results are presented of recent measurements of hydromagnetic (hm) emissions made at four Pacific Ocean stations, widely separated in both latitude and longitude. The signals are almost always observed simultaneously at the four locations. The repetition frequency of the emission fine structure is found to be highly regular and is the same at all stations for any given hm-emission event. The structural elements occur simultaneously at stations in the same hemisphere, but the elements are found to be alternately spaced (180° out of phase) at stations on opposite sides of the equator. Hence, energy is being received periodically and alternately in the northern and southern hemispheres. The result is applied to the evaluation of three recently proposed models for the generation of hm emissions; two of the three models are immediately rejected. It is also observed that occasionally the fine-structure repetition frequency exhibits the presence of a harmonic. This effect is tentatively attributed to a superposition of signals from opposite hemispheres. (auth)

26449 ENHANCEMENT OF HYDROMAGNETIC EMISSIONS AFTER GEOMAGNETIC STORMS. R. C. Wentworth (Lockheed Missiles and Space Co., Palo Alto, Calif.). J. Geophys. Res., 69: 2291-8(June 1, 1964).

Records for the three-year period from August 1, 1960, to July 16, 1963, were examined for the occurrence of hydromagnetic (hm) emissions in California. It has been found that hm emissions are more likely to occur in the seven days after geomagnetic storms than during days in geomagnetically quiet periods. (auth)

26450 AN EVALUATION OF THE CURRENT-JET HYPOTHESIS OF WHISTLER GENERATION. G. McK. Allcock (Dominion Physical Lab., Lower Hutt, N. Z.). J. Geophys. Res., 69: 2299-2303(June 1, 1964).

Experimental evidence is cited which is apparently irreconcilable with Hoffman's current-jet hypothesis of whistler generation. The increase in dispersion of successive components of low-latitude multiple-stroke whistlers found by Clarence and the energy required by thundercloud electrons to escape into the exosphere are examined in relation to the hypothesis. (auth)

26451 A STUDY OF SLOWLY VARYING AND PULSATING IONOSPHERIC ABSORPTION EVENTS IN THE AURORAL ZONE. R. R. Brown (Kiruna Geophysical Observatory, Sweden). J. Geophys. Res., 69: 2315-21(June 1, 1964).

A study of the features of slowly varying and pulsating ionospheric absorption events recorded by the Kiruna riometer in the morning hours indicates that both events involve electron precipitation on the atmosphere. In addition, it is concluded that pulsations in absorption do not represent a separate type of event, but arise, instead, from slowly varying events due to modulation of electron precipitation by hydromagnetic processes. (auth)

26452 A METHOD FOR DETERMINING D-REGION ELECTRON-DENSITY PROFILES UTILIZING A CAPACI-

TIVE IMPEDANCE ROCKET PROBE. J. R. Herman (Pennsylvania State Univ., University Park). J. Geophys. Res., 69: 2329-36(June 1, 1964).

An analysis of a capacitive impedance probe for measuring electron density in the lower ionosphere is presented. The method employed accounts for the effects of the ion sheath surrounding the rocket probe and the collisions of oscillating electrons with neutral particles. The applicability of the method and theory developed is illustrated by using ionospheric models to determine typical impedance characteristics of the probe. (auth)

26453 GEOMAGNETIC AND SOLAR DATA. J. Virginia Lincoln (National Bureau of Standards, Boulder, Colo.). J. Geophys. Res., 69: 2379-81(June 1, 1964).

Some data on geomagnetic activity from October 1963 through January 1964 are tabulated, together with provisional sunspot numbers for January 1964 and finial sunspot numbers for the whole solar disk in 1963. (D.C.W.)

26454 EFFECTS OF NUCLEAR TESTING AT MEDIUM FREQUENCIES. G. L. Hower and L. B. Craine (Washington State Univ., Pullman). J. Geophys. Res., 69: 2388-90(June 1, 1964).

The effects of a Soviet and an American nuclear test on records made of background noise levels at 834 kcps during 1962 at Pullman, Washington, were examined. The recorded signal decreased substantially, and the absorption effects from the two tests lasted about 3.5 and 1.0 hrs, respectively. The observations at 834 kcps were far more sensitive than those made simultaneously with a 27.6-Mcps riometer. An explanation for the observations is presented. (D.C.W.)

26455 DIRECT OBSERVATIONS OF LOW-ENERGY ELECTRONS IN THE DISTURBED IONOSPHERIC E-REGION. W. J. Heikkila and D. L. Matthews (Defence Research Telecommunications Establishment, Ottawa). Nature, 202: 789-90(May 23, 1964).

Differential spectra of electrons of 20- to 3000-ev energy were directly measured in the ionosphere. Electrons of energy 100 kev, precipitated into the ionosphere by processes not understood but closely related to magnetic activity, are considered to be the main cause of these events. Results of additional measurements on electrons above 10 kev are discussed. It is estimated from pitch angle dependence and stopping processes that below 100 ev the secondary electrons, and above 1 kev the primaries, dominate the fluxes observed. The maximum energy flux observed was of the order of 1 erg/cm^2/sec in the primaries, and about the same in the secondaries. In the primaries, it is estimated that nearly all the energy was in the range 1 to 5 kev, and in the secondaries between 20 and 100 ev. (P.C.H.)

26456 ATMOSPHERIC TIDES AND ASSOCIATED MAGNETIC EFFECTS. J. A. Fejer (Southwest Center for Advanced Studies, Dallas). Rev. Geophys., 2: 275-309(May 1964).

The dynamical theory of atmospheric tides and its relation to observations on the ground and in the upper atmosphere are reviewed, together with the dynamo theory of geomagnetic field variations on quiet days. Several theories for the daily magnetic variations observed during magnetically disturbed days are also considered. 75 references. (D.C.W.)

26457 PHYSICAL PROCESSES IN THE D REGION OF THE IONOSPHERE. George C. Reid (National Bureau of Standards, Boulder, Colo.). Rev. Geophys., 2: 311-33 (May 1964).

The present understanding of the physical processes likely to be of major importance in determining the characteristics of the D region of the ionosphere is reviewed. The basic processes are divided into three categories: primary ionizing mechanisms; interactions involving free electrons, ions, and the neutral gas; and mechanical and electrodynamic mechanisms that lead to redistribution of ionization. The information currently available in each of these categories is discussed, and major gaps in present knowledge are indicated. 50 references. (auth)

26458 PHASE METHOD OF TERRESTRIAL MAGNETIC FIELD MEASUREMENT USING NUCLEAR-RESONANCE FILTER. P. M. Borodin. Vestn. Leningr. Univ., Ser. Fiz. i Khim., No. 1, 157-9(1964).

A generator was used as a nuclear-resonance filter for terrestrial magnetic field measurements with a broken reverse coupling, the input of which consists of a phasing coil and the output a receiver coil. The phase shift obtained from measuring the terrestrial field H_0 is displayed as Lissajous figures on an oscilloscope. The sensitivity of the device is shown to be 0.1 to 0.3 gamma, and an undistorted signal registered from magnetic perturbations of $\tau \geq 2$ sec is ensured. This is shown to allow simultaneous measurement of short-period field variations as well as slow changes. (A.I.D. Press, Vol. 2, No. 237, June 1964)

Low Temperature Physics

26459 (AD-437194) RESEARCH IN SOLID STATE THEORY. Progress Report. (Rutgers Univ., New Brunswick, N. J.). Apr. 1964. Contract Nonr 404(13). 10p.

Studies on the theory of superconductivity are reported. (T.F.H.)

26460 ADVANCES IN CRYOGENIC ENGINEERING. VOLUME 9. PROCEEDINGS OF THE 1963 CRYOGENIC ENGINEERING CONFERENCE, BOULDER, COLORADO, AUGUST 19-21, 1963. K. D. Timmerhaus, ed. Advan. Cryog. Eng., 9: 1-580(1964). New York, Plenum Press, 1964. (CONF-176). $17.50.

Sixty-nine papers are included. Separate abstracts were prepared for 6. Six papers were previously abstracted for NSA; see abstracts 17: 19619, 25849, 36375, 40962, 41477, and 41546. (M.J.T.)

For abstracts of individual papers see: 26461, 26462, 26463, 26464, 26465, and 26466.

26461 METASTABLE SUPERHEAT IN NUCLEATE BOILING OF CRYOGENIC LIQUIDS. T. H. K. Frederking (Univ. of California, Los Angeles). Advan. Cryog. Eng., 9: 71-6(1964).

Superheat data of liquified gases are compared with an empirical nitrogen correlation, presuming thermodynamic similitude. It is concluded that thermodynamic similitude can be used to obtain fast superheat estimates in nucleate boiling. (M.J.T.)

26462 NUCLEATE BOILING HEAT TRANSFER COEFFICIENTS AND PEAK NUCLEATE BOILING FLUXES FOR PURE LIQUID NITROGEN AND OXYGEN ON HORIZONTAL PLATINUM SURFACES FROM BELOW 0.5 ATMOSPHERE TO THE CRITICAL PRESSURES. D. N. Lyon, P. G. Kosky, and B. N. Harman (Univ. of California, Berkeley). Advan. Cryog. Eng., 9: 77-87(1964).

An experiment to obtain accurate data for a variety of liquids on a surface of a given microscopic chemical and physical character, eliminating variations in the solid surface and thus accurately identifying the role of liquid properties in the boiling process, is reported. Results for

peak heat transfer data of liquid nitrogen and oxygen are given. (M.J.T.)

26463 FLUX JUMPING AND DEGRADATION IN SUPERCONDUCTING SOLENOIDS. H. Riemersma, J. K. Hulm, and B. S. Chandrasekhar (Westinghouse Electric Corp., Pittsburgh). Advan. Cryog. Eng., 9: 329-37(1964).

A model is proposed in which the transition of a superconducting solenoid into the normal state is initiated by a flux jump, releasing sufficient energy to raise a length of wire above its critical temperature and thus nucleating a normal zone. It is shown theoretically and experimentally that a finite resistance must appear at the instant a superconducting solenoid goes normal. It is demonstrated experimentally that flux jumps do occur and suggested that they cause the finite resistance. Certain environmental conditions minimizing the effect of a flux jump are suggested. (M.J.T.)

26464 INFLUENCE OF MECHANICAL CONSTRAINTS ON CRITICAL CURRENTS OF SUPERCONDUCTING SURFACE LAYERS OF Nb_3Sn ON NIOBIUM AND V_3Ga ON VANADIUM IN TRANSVERSE MAGNETIC FIELDS. C. B. Mueller and E. J. Saur (Universität, Giessen, Ger.). Advan. Cryog. Eng., 9: 338-41(1964).

An empirical relation between the critical currents and constraints in transverse magnetic fields for superconducting layers of Nb_3Sn on niobium and V_3Ga on vanadium is not found, since a well-defined equation for the quenching curve does not exist. However, a decrease in the critical currents was found at fixed magnetic field with increase of the applied constraint. (M.J.T.)

26465 A SUPERCONDUCTING DIRECT-CURRENT GENERATOR. S. L. Wipf (Westinghouse Electric Corp., Pittsburgh). Advan. Cryog. Eng., 9: 342-8(1964).

A superconducting dynamo was constructed, similar to an ordinary d-c generator, and having a much higher efficiency and allowing more constructional freedom than one previously constructed like a homopolar generator. An important application of this generator is to energize superconducting magnets, especially when large currents are needed. (M.J.T.)

26466 SOME EXPERIMENTS RELATING TO THE LAYOUT OF SUPERCONDUCTING TRANSFORMERS. P. A. Klaudy (Technische Universität, Graz). Advan. Cryog. Eng., 9: 349-59(1964).

Tests carried out on transformer models of a ring type and with enclosed magnetic fields (by means of superconducting sheet metals) showed that with suitable layout current densities up to about 150 amp/mm^2 in niobium wires (0.004 in. diameter) could be reached without destroying the superconductivity of the wires. Flux densities within the winding spaces measured up to 400 gauss. Screening of ac magnetic fields of 50 cps by means of superconducting sheet metals (lead, niobium) arranged perpendicular to the direction of the lines of force seems to be practicable. (auth)

26467 THE SURFACE IMPEDANCE OF SUPERCONDUCTORS. J. R. Waldram (Univ. of Cambridge, Eng.). Advan. Phys., 13: 1-88(Jan. 1964).

Measurements of the surface impedance of superconducting Sn and Sn–In alloys at 3000 Mcps obtained by measuring the bandwidth and characteristic frequency of a resonator containing the specimen are reported. The results are compared in detail with the microscopic theory, those on the low temperature surface reactance being reduced to values of d-c penetration depth. At the lowest temperatures the penetration depth, λ, shows slight downward curvature when plotted against $y(T/T_c) = [1 - (T/T_c)^4]^{-1/2}$ for $y < 1.2$, in contrast to the larger effect predicted by the theory. At higher temperatures the theory overestimates λ by about 5×10^{-7} cm. For samples containing more than 2% In, $\lambda(y)$ appears to be linear at all temperatures. The slope, $d\lambda/dy$, agrees with the predicted values for large y. The low-temperature surface resistance follows the usual empirical rule. A new method of obtaining λ at absolute zero, free from zero error, by analysis of the resistance and reactance data is presented. The extension of the theory to anisotropic metals is discussed and applied to the results for pure specimens. Good agreement is found, provided that allowance is made for a rather complex anisotropy of the energy gap, with a total range of about 30%; and a new method of measuring anisotropy of the energy gap is proposed. The simple relations between the Pippard parameters, G_1 and G_2, and the normal state skin depth discovered by Pippard and Fawcett is shown to be essentially accidental. In considering the surface impedance of pure specimens very near T_c, it is shown that the coherence length is certainly finite at T_c in SN and a new interpretation is given for the results of Williams on pure Al near T_c. Finally, the small disagreements between experiment and theory are analyzed and ascribed to a slightly wrong form for the energy gap as a function of temperature used by the theory. It is suggested that this may be explained if different pieces of the Fermi surface have different energy gaps in Sn. The general conclusion is that, if modified to allow for the anisotropy of the Fermi surface and the energy gap, the theory is very successful when applied to the known data on Sn at frequencies up to 40,000 Mcps. (auth)

26468 THEORIES OF LIQUID HELIUM THREE. V. J. Emery (Univ. of California, Berkeley). Ann. Phys. (N. Y.), 28: 1-17(June 5, 1964).

It is suggested that Landau's theory of a Fermi liquid may be useful if the lifetime of a quasiparticle is much longer than the duration of a collision. This condition allows the theory to be used for liquid He^3 at temperatures up to 0.3°K. The quasiparticle scattering amplitudes are calculated in the ladder approximation, and it is shown that it is not possible to fit the velocity of sound and susceptibility of liquid He^3 unless the interaction between quasiparticles is significantly different from the interaction between two isolated helium atoms. The results suggest that the effective interaction is an average, repulsive for particles scattering in relative D-states, and, therefore, show why the predicted second order phase transition has not yet been observed in liquid He^3. The simple theory predicts a sharp decrease in the transport properties of a Fermi liquid immediately above the critical temperature T_c for a second order phase transition. (auth)

26469 STRESS FIELD PINNING BY LOCALIZED COMPOSITION FLUCTUATIONS IN HARD SUPERCONDUCTORS. Louis E. Toth and Ira P. Pratt (Univ. of California, Berkeley). Appl. Phys. Letters, 4: 75-7(Feb. 15, 1964). (UCRL-11158)

It is shown that an array of isolated composition fluctuations can result in localized stress fields capable of pinning a continuous filamentary phase. The strain energy is calculated, and the pinning forces on both superconducting filaments and fluxoids are estimated and compared to those estimated for other pinning mechanisms. (D.C.W.)

26470 "TRAINING" AND FLUX JUMPING IN SUPERCONDUCTING SOLENOIDS OF Nb–Zr AND Nb–Ti. M. S. Lubell and G. T. Mallick (Westinghouse Electric Corp., Pittsburgh). Appl. Phys. Letters, 4: 206-7(June 15, 1964).

Training was induced and annihilated in small superconducting solenoids of Nb–45% Ti and Nb–25% Zr at 4.2°K by cycling an external magnetic field. Many flux jumps were observed when the solenoid was energized so that its self-field was in the same direction as the external field. Training was also induced without field cycling by self-field energization. When the temperature was raised above 4.2°K, training was not observed, and flux jumping decreased. (D.C.W.)

26471 ABSENCE OF ZERO SOUND IN SUPERFLUID FERMI SYSTEMS. Donald H. Kobe (National Taiwan Univ., Taipei). Chinese J. Phys. (Taiwan), 1: 42-8(Oct. 1963).

A secular equation is derived for collective excitations corresponding to bound pairs of Bogoliubov quasi-particles with parallel spin. When the system is superfluid the secular equation cannot be solved. When the system is normal, the secular equation gives zero sound. (auth)

26472 CRITICAL CURRENTS OF A SUPERCONDUCTOR OF THE SECOND KIND. J. W. Heaton and A. C. Rose-Innes (Services Electronics Research Lab., Baldock, Herts, Eng.). Cryogenics, 4: 85-9(Apr. 1964).

The critical currents and magnetizations of wires of pure Nb–Ta alloys were measured to determine the extent to which the presence of the mixed superconducting state contributes to high current-carrying capacity in a magnetic field. The results show that a pure superconductor of the second kind cannot support a substantial resistanceless current in a transverse magnetic field. Apparently the current is limited by the Lorentz force acting upon it, and the mixed state is not by itself a high current-carrying state. Defects, as well as the mixed state, appear to be necessary for a superconductor of the second kind to have high current-carrying properties. (D.C.W.)

26473 SEARCH FOR SUPERCONDUCTIVITY IN NEPTUNIUM AND PLUTONIUM USING A LIQUID HELIUM-3 CRYOSTAT. G. T. Meaden and T. Shigi (Oxford Univ.). Cryogenics, 4: 90-2(Apr. 1964).

An unsuccessful attempt was made to observe superconductivity in neptunium and plutonium by electrical resistance methods. Measurements were made down to 0.41 and 0.50°K, respectively, on the neptunium and plutonium samples. The cryostat used is described, together with precautions taken to avoid alpha contamination. (D.C.W.)

26474 THE PRODUCTION OF HIGH MAGNETIC FIELDS USING A NIOBIUM–ZIRCONIUM ALLOY. E. M. Savitskii, V. V. Baron, V. R. Karasik, S. Sh. Akhmedov, V. Ya. Pakhomov, and M. I. Bychkova (Physical Inst., Academy of Sciences, USSR). Cryogenics, 4: 102-3(Apr. 1964).

The superconducting properties of wire made from a Nb alloy with 25% Zr were studied. The effects of annealing temperature and deformation on the magnetic field dependence of its critical current were determined. The dependence of the critical current on diameter was also studied, as was the dependence of the critical current density at which superconductivity is destroyed in external magnetic field. Extrapolation of the results indicates that for a 1-cm inner gap and 80-cm^3 volume of winding, the maximum field strength at the center of a solenoid would be about 60 kgauss at 4.2°K. (D.C.W.)

26475 THE SUPERCONDUCTIVITY AND MAGNETISM OF THE ACTINIDE METALS. G. T. Meaden (Université, Grenoble, France). Cryogenics, 4: 105-7(Apr. 1964).

The distribution of magnetism and superconductivity in the actinide, lanthanide, and transition metals is discussed in relation to the model and observations of Hamilton and Jansen, using a revised periodic table. (D.C.W.)

26476 THIN FILM CRYOTRONS—A REVIEW. PART II. Keiichi Matano. Denki Shikensho Iho, 27: 860-72(Nov. 1963). (In Japanese)

Some advanced problems concerning superconductive devices are discussed. Works on the relation between the properties of Sn and In films and their conditions of vacuum deposition are reviewed. The phenomena and theory of the tunneling effect between superconductors and the quantization of flux are explained, and some circuit applications and the possibility of future development of thin film cryotrons are discussed. 127 references are included. (auth)

26477 THIN-FILM CIRCUIT TECHNOLOGY. PART II. THIN-FILM SUPERCONDUCTING DEVICES. Hollis L. Caswell (International Business Machines Corp., [Yorktown Heights, N. Y.]). IEEE (Inst. Elec. Electron. Engrs.), Spectrum, 1: 84-94; 99(May 1964).

A brief review of the theory and properties of superconductors is presented. The applications of thin-film superconductors as switching devices and storage devices in computer memories are discussed. (C.E.S.)

26478 SUPERCONDUCTING MAGNETS. Robert E. Gang and Harry E. Weaver (Varian Associates, Palo Alto, Calif.). Ind. Res., 6: No. 5, 76-81(May 1964).

The achievement of greatly increased steady magnetic fields through the use of superconductors at liquid helium temperatures is surveyed. Practical limitations of conventional iron or iron-cobalt electromagnets, due to saturation, are described. Stability and homogeneity are discussed. The Meissner effect is explained. Its absence in a few alloys and the resulting zero-resistance high magnetic fields are described. (M.J.T.)

26479 ANGULAR DEPENDENCE OF THE SUPERCONDUCTING NUCLEATION FIELD. M. Tinkham (Faculte des Sciences, Orsay, France). Phys. Letters, 9: 217-18 (Apr. 15, 1964).

It is pointed out that the values of H_θ, the critical nucleation field, measured as a function of the angle θ between the field direction and the plane of the film, are in remarkably good agreement with those predicted by the interpolation formula $(H_\theta \cos\theta/H_{c\parallel})^2 + (H_\theta \sin\theta/H_{c\perp}) = 1$, proposed previously for interpolating between the parallel and perpendicular critical fields of thin film. In this case the formula reduces to $0.35\ h^2\cos^2\theta + h\sin\theta = 1$. A qualitative explanation is attempted for the agreement. (M.J.T.)

26480 OBSERVATION OF SURFACE SUPERCONDUCTIVITY ABOVE THE THERMODYNAMIC CRITICAL FIELD IN TYPE I SUPERCONDUCTORS. B. Rosenblum and M. Cardona (Radio Corp. of America, Princeton, N. J.). Phys. Letters, 9: 220-1(Apr. 15, 1964).

The observation of surface superconductivity in type I materials—$Pb_{0.99}Tl_{0.01}$, more dilute alloys, and pure lead—is reported. For type I materials, κ can be determined from these studies. (M.J.T.)

26481 ENERGY GAP OF THE HIGH FIELD SUPERCONDUCTOR NbZr. I. Dietrich (Siemens and Halske AG, Munich). Phys. Letters, 9: 221-2(Apr. 15, 1964).

Results of previous energy-gap experiments for type II superconductors are given. To decide whether a high field superconductor can show the complete BCS energy gap, tunneling experiments were performed on the cubic centered Nb66 Zr33 alloy, with an H_{c2} value of 80,000 Oe. After annealing, samples were 25% Zr. Two energy gaps are found

from current vs voltage plots. The average value of the connecting constant between energy gap and transition temperature is found to be in relatively good agreement with the value from the BCS theory. (M.J.T.)

26482 THE SUPPRESSION OF EDGE EFFECTS IN SUPERCONDUCTING FILMS. A. R. Tyler and P. A. Walker (International Computers and Tabulators Engineering Ltd., Stevenage, Herts, Eng.). Phys. Letters, 9: 226-7 (Apr. 15, 1964).

The critical field of adjacent tin-silver films is derived as a function of film thickness and temperature, using equations for thickness dependence of critical field and of the tin-silver combination critical temperature. Consequent predictions for the magnetic-field transition width were verified experimentally. (M.J.T.)

26483 VIBRATIONS OF QUANTISED VORTICES IN LIQUID HELIUM II. E. S. Raja Gopal (Oxford Univ.). Phys. Letters, 9: 230-2(Apr. 15, 1964).

The collective oscillations in an array of vortices in liquid helium II are analyzed by the familiar hydrodynamic methods. The frequency of an oscillating vortex is calculated. Experimentally based values of the core radius are compared with two previous estimates. (M.J.T.)

26484 CURRENT FLUCTUATIONS IN A SUPERCONDUCTING CIRCUIT CARRYING A CIRCULATING CURRENT. H. J. Fink and A. Zacharias (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 135: A1-3(July 6, 1964).

At 4.2°K and 5.514 Gc/sec persistent currents in lead, vanadium, and niobium are free from fluctuations to less than 1.1×10^{-9}, 4.3×10^{-9}, and 8.9×10^{-10} of full shot noise, respectively. (auth)

26485 PROPERTIES OF He^4 NEAR THE γ PHASE. Guenter Ahlers (Univ. of California, Berkeley). Phys. Rev., 135: A10-16(July 6, 1964). (UCRL-11298)

The heat capacity of solid ^4He was measured at several constant volumes in the vicinity of the γ phase. The heat capacity of the α phase near the melting line was found to decrease exceptionally rapidly with decreasing molar volume, and the heat capacity of the γ phase was found to increase with decreasing molar volume. The unusual behavior of the γ phase is consistent with the existence of anomalous thermal excitations in this phase. The thermal expansion coefficient and the compressibility of the γ phase were estimated. Their temperature dependences are consistent with the volume dependence of the heat capacity. The triple-point temperatures and the λ temperature at the solid-liquid boundary were found to be 1.462, 1.773, and 1.763°K, respectively. (auth)

26486 PHENOMENOLOGICAL MODEL FOR THE ELECTRONIC THERMAL CONDUCTIVITY OF SUPERCONDUCTORS. Ashok Kumar Gupta and G. S. Verma (Allahabad Univ., India). Phys. Rev., 135: A16-19(July 6, 1964).

A phenomenological model is proposed within the framework of BCS theory and the Boltzmann equation approach for the electronic thermal conductivity of superconductors limited by phonon scattering. Values of the parameters of the model are determined from comparison with the experimental data. In the case of weak coupling of electrons and lattice vibrations, it is found that τ_s, the time a quasiparticle takes to relax to the equilibrium flow of supercurrent, is comparable with τ_n in the normal state. In the case of strong electron-phonon interaction, it is found that τ_s is 10^{14} times τ_n at the reduced temperature $t = 0.80$. (auth)

26487 ENERGY GAP MEASUREMENTS BY TUNNELING BETWEEN SUPERCONDUCTING FILMS. I. TEMPERATURE DEPENDENCE. D. H. Douglass, Jr., and R. Meservey (Massachusetts Inst. of Tech., Lexington). Phys. Rev., 135: A19-23(July 6, 1964).

The electron tunneling technique was used to measure the energy gap $2\Delta(t)$ as a function of temperature in aluminum and tin films. The temperature dependence of the normalized gap $\Delta(t)/\Delta(0)$ for each film agreed rather well with the BCS theory, although a small consistent deviation was found in which the measured values of the gap were slightly larger than predicted by theory. In the case of aluminum, considerable random scatter in the absolute values of $2\Delta(0)$ for the various films was found. (auth)

26488 ENERGY GAP MEASUREMENTS BY TUNNELING BETWEEN SUPERCONDUCTING FILMS. II. MAGNETIC FIELD DEPENDENCE. R. Meservey and D. H. Douglass, Jr. (Massachusetts Inst. of Tech., Lexington). Phys. Rev., 135: A24-33(July 6, 1964).

The magnetic field dependence of the energy gap 2Δ was measured by the electron tunneling technique over the temperature interval $T_c \geq T \geq 0.7\ T_c$ on eight aluminum films ranging in thickness d from 420 to 9850 Å. Measurements of the reduced energy gap versus the reduced field can be represented as a family of curves with a single parameter d/λ. For $d/\lambda > 1$ the $[\Delta(O,T)]^2$ versus $[H/H_c]^2$ curves have an initial small negative curvature and then drop abruptly at H_c. For $d/\lambda < 1$ the curvature is always positive, decreasing in magnitude as the field increases. For $d/\lambda \approx 1$ an almost straight line is obtained. The results are qualitatively as predicted by the Ginzburg-Landau (GL) equations for $d/\lambda \geq 1$ but not for $d/\lambda < 1$. It is suggested that this discrepancy with solutions of the GL equations may arise from the breakdown of the assumption that the order parameter is independent of position. Measurements on a lead film of thickness 1000 Å at $T/T_c = 0.14$ showed that the energy gap goes smoothly to zero with positive curvatures as H approaches H_c. (auth)

26489 EVIDENCE FOR NORMAL REGIONS AT LOW TEMPERATURES IN THE SUPERCONDUCTING MIXED STATE. Bruce Rosenblum and Manuel Cardona (RCA Labs., Princeton, N. J.). Phys. Rev. Letters, 12: 657-9 (June 15, 1964).

The microwave surface resistances of type-II Pb–Tl, Bi–In, In–Pb, Nb, Nb_3Sn, and V_3Si were previously measured. The observed absorption of microwave energy in the mixed state is most readily explained by a model which has normal regions of finite extent at the centers of the Abrikosov flux tubes. The bases for the model are presented, and the observations are discussed in relation to it. (D.C.W.)

26490 LONG SUPERCONDUCTIVE DELAY LINES. R. J. Allen (Martin Co., Baltimore). Proc. IEEE (Inst. Elec. Electron. Engrs.), 52: 615-16(May 1964).

The use of miniature superconducting coaxial cables for transmission line storage in memory devices is discussed. The characteristics of a niobium coaxial cable using a Teflon dielectric are reported. (C.E.S.)

26491 A STUDY OF THE BARDEEN-COOPER-SCHRIEFFER DISTRIBUTION. J. Hoegaasen (Institutt for Teoretisk Fysikk, N.T.H. Trondehim, Norway). Proc. Phys. Seminar Trondheim, No. 4, 19p.(1964).

The distribution of the number of particles in the BCS state is studied. It is shown to possess only one maximum. The binomial distribution, which corresponds to the degenerate model of the pairing force, appears to have remark-

able extremum properties. In particular, it is the flattest and broadest among all distributions corresponding to the same number of particles. From these properties, it is concluded that, for systems with near-lying individual states, the most probable value of the number of particles is the average value. (auth)

26492 SUPERFLOW OF He II THROUGH NARROW CHANNELS. Toshihiko Tsuneto (Osaka Univ.). Progr. Theoret. Phys. (Kyoto), 31: 330-1(Feb. 1964).

It is shown that while an ideal Bose gas in the condensed phase cannot flow through narrow channels even if friction with walls is negligible, the condensate of an imperfect Bose gas with short-range interaction of the hard-core type can exhibit the superleak. In fact, the condensate behaves like an incompressible fluid. (auth)

26493 FAST-ACTING SUPERCONDUCTING POWER SWITCHES. D. L. Ameen and P. R. Wiederhold (Ion Physics Corp., Burlington, Mass.). Rev. Sci. Instr., 35: 733-7(June 1964).

Superconducting switches operating on the basis of superconducting-to-normal transitions are considered as a means of initiating high power pulsed discharges from inductive energy storage systems. An analysis of transition times, power losses, and design techniques is presented. Thermally and magnetically activated switches consisting of long, noninductively-wound, 0.005-in. Nb–Zr wires with normal resistances in the kilohm region were tested. A linear representation of the reappearance of resistance during a superconducting-to-normal transition yielded values up to 10^5 Ω/sec. A mathematical analysis, which is in good agreement with experimental results, is given. Factors influencing the rate of increase of resistance are reviewed. (auth)

26494 PHOTOEFFECT IN A SUPERCONDUCTOR. V. V. Slezov. Soviet Phys.-Solid State (English Transl.), 5: 2161-5(Apr. 1964). (Translated from Fiz. Tverd. Tela, 5: 2951-7(Oct. 1963)).

The general formula describing the photocurrent as a function of frequency and temperature is given. The limit cases are considered. It is shown that the displacement of the red limit of the photoeffect is equal to the energy gap in the superconductor. The frequency dependence of the photocurrent in the vicinity of the new limit differs from that in the case of a normal metal as a result of redistribution of the electrons in momentum space. (auth)

26495 MAGNETIC PROPERTIES OF A SUPERCONDUCTOR OF THE SECOND KIND. Tracy Stewart Kinsel. Thesis, New Brunswick, N. J., Rutgers Univ., 1963. 98p.

Magnetization curves have been obtained on nine superconducting indium specimens alloyed with concentrations of bismuth from 1.50 to 4.00 atomic percent. The measurements were performed by means of a vibrating sample magnetometer. The specimens had values of the Ginzburg-Landau parameter, K, ranging from 0.63 to 1.47. Values of K determined experimentally from different aspects of the magnetization curves near the transition temperature agreed with each other as well as with the value obtained from the electrical resistivity using a relation due to Goodman and Gor'kov. At temperatures below the transition temperature, the experimental results were interpreted in terms of an effective K that is temperature dependent. This effective K was found to increase by about 25% between the transition temperature and 0°K in accordance with the calculations of Gor'kov. With this effective K the theory of Abrikosov describes the magnetization curves for temperatures far removed from the transition temperature. It was also found that the critical K value separating first and second kind superconductors could also be extended to lower temperatures by using the value of $1/\sqrt{2}$ which arises in the Ginzburg-Landau theory near the transition temperature. These two experimental results lead to the expectation that a specimen may behave as a first kind superconductor with a K slightly less than the critical value near the transition temperature, but at lower temperatures K may exceed the critical value and second kind behavior may be displayed. This change of magnetic behavior was observed for one specimen. The major source of a small systematic disagreement with theory was shown to be due to irreversibility in the experimental magnetization curves. In addition to the results indicated above reasonable values of $\lambda(0)$, the 0°K value of the low field penetration depth, and γ, the coefficient of the normal state specific heat were obtained from an analysis of the critical magnetic field curves. (Dissertation Abstr.)

26496 METHOD FOR THE DEPOSITION OF THIN FILMS BY ELECTRON BOMBARDMENT. Horace T. Mann (to Space Technology Labs., Inc.). U. S. Patent 3,132,046. May 5, 1964. Filed Sept. 28, 1960.

A method for fabricating thin-film superconducting elements of predetermined size and shape is presented. A substrate of dielectric material corresponding in size and shape to the thin-film element is deposited by electron beam polymerization. The substrate is then exposed to a stream of metal particles in vacuum to produce a continuous coating of metal. (C.E.S.)

Neutron Physics

Refer also to abstracts 26539, 26540, 26541, 26542, 26543, 26544, 26545, 26546, 26547, 26554, and 26871.

26497 (AWRE-O-66/63) SOLUTION OF THE TWO-DIMENSIONAL AXIALLY SYMMETRIC MULTIGROUP STATIONARY NEUTRON TRANSPORT EQUATION ON THE IBM 7030 (STRETCH) COMPUTER. M. P. Saward and R. D. Wade (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Apr. 1964. 113p.

The program TURTLE is described. This is the AWRE program to solve the two-dimensional axially symmetric multigroup stationary neutron transport equation on the IBM 7030 (STRETCH) computer. The formulation of the difference equations is discussed and also the program facilities. Full details of the input to the program are given, together with other details such as flow diagrams of the more complicated subroutines. A listing of the program is not included. (auth)

26498 (PAN-280) TEMPERATURE DEPENDENCE OF SPIN FLUCTUATION SCATTERING OF NEUTRONS ON PYRRHOTITE. Sz. Kraśnicki (Polish Academy of Sciences. Inst. of Nuclear Physics, Krakow); Z. Dimitrijević, R. Maglić, V. Marković, J. Todorović (Institut za Nuklearne Nauke "Boris Kidric," Belgrad); and A. Wanic (Polish Academy of Sciences. Inst. of Nuclear Physics, Krakow). Oct. 1963. 26p.

By means of the triple axis Krakow neutron spectrometer installed in Vinča (Yugoslavia), coherent inelastic scattering of monochromatic neutrons (λ_0 = 1.376 Å) connected with τ = (00.1) was investigated at various temperatures above room temperature up to 400°C, i.e., above the critical point (T_C = 320°C) of the spin alignment in pyrrhotite. The intensity of the (00.1) scattering cone increases with the

temperature but its magnon character does not change. Only at temperatures above 200°C do the widths of the magnon peaks begin to increase. This temperature is not very sensitive to the energy of a given magnon group. The high degree of inelasticity is maintained over the critical point region and the mean energy transfer is close to that for low temperature. The results are discussed in terms of the magnon lifetime and temperature dependence of the effective exchange coupling. (auth)

26499 (RISÖ-73) HIGHER ORDER CONTAMINATION IN CRYSTAL MONOCHROMATIZATION OF NEUTRONS. O. W. Dietrich and J. Als-Nielsen (Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø). Feb. 1964. 11p.

A calculational method and an experimental foil transmission method for determination of the higher order contamination in neutron diffraction are discussed. As an example, the higher order contamination in Be(100) reflections is determined by both methods. The calculational method gives the best results for small contamination. (auth)

26500 EXACT AND ASYMPTOTIC SOLUTION OF THE ENERGY-DEPENDENT BOLTZMANN EQUATION IN THE STUDY OF THE NEUTRON SLOWING DOWN. V. C. Boffi, F. Knoke, V. G. Molinari, and R. Scozzafava (CNEN, Rome). Ann. Phys. (N. Y.), 27: 283-96(May 1964).

The exact and asymptotic solution of the Boltzmann equation that governs the stationary energy distribution of neutrons slowing down in an infinite homogeneous medium in the case of a general capture law is obtained. Specific results are given for particular cases of variation of the cross sections versus the neutron velocity. (auth)

26501 EXACT AND ASYMPTOTIC TIME-ENERGY DISTRIBUTION OF NEUTRONS SLOWING DOWN IN AN INFINITE HOMOGENEOUS MEDIUM. V. C. Boffi (CNEN, Rome). Ann. Phys. (N. Y.), 27: 297-330(May 1964).

A new method for integrating the time-energy dependent Boltzmann equation for neutrons slowing down in an infinite homogeneous medium is presented. The exact step-by-step energy distribution at the time t is constructed. The behavior of the exact distribution for small values of energy and then for large values of time is derived as the limit of the sequence of the continuous functions, which step-by-step represent the physical solution of the problem. Information on the behavior for large and small values of time of the exact step-by-step time-energy distribution is also given. How the absorption can be accounted for is finally mentioned. (auth)

26502 STUDY OF THE DIFFUSION OF NEUTRONS IN BERYLLIUM BY THE PULSE TECHNIQUE. I. F. Zhezherun. At. Energ. (USSR), 16: 224-8(Mar. 1964). (In Russian)

Literature data on the diffusion characteristics and the cross sections for thermal neutrons in Be exhibited a considerable scatter; this was possibly due to various impurities in the materials used by the various investigators. Measurements were therefore undertaken to determine these properties by the diffusion method, using 40 × 40 × 40 or 10 × 50 × 100 mm plastic-covered Be specimens prepared by powder metallurgical techniques, with a density of 1.79 g/cm^3. One of the beams of the linear accelerator at the I. V. Kurchatov Institute was used as the neutron source for the experiments. The duration of the pulses was 1 microsecond; their frequency ranged from 50 to 100 herz; otherwise, the experimental details were identical with those used by the author for similar studies with BeO (Atomnaya Energ., 14: 193(1963)). It is concluded that one of the reasons for the divergence of the previous results may be neglection of the terms containing ^{6}B. The following values were obtained: transfer length = 1.503 ± 0.016 cm; diffusion length = 21.8 ± 1.0 cm; average neutron lifetime = 3.82 ± 0.17 msec; effective absorption cross section at room temperature = 8.8 ± 0.4 mbarn; and effective absorption cross section at a neutron velocity of 2200 m/sec = 10.0 ± 0.4 mbarn. (TTT)

26503 THE ABSOLUTE DETERMINATION OF THE NUMBER OF NEUTRONS EMITTED BY A SOURCE BY MEANS OF THE ASSOCIATED PARTICLE METHOD. A. S. Karamyan, B. I. Kuzeev, R. P. Kress, Yu. S. Silin, G. M. Stukov, V. T. Shchebolev, and I. A. Yaritsyna. At. Energ. (USSR), 16: 252-3(Mar. 1964). (In Russian)

The associated particle method is based on the comparison of the neutron flux from the source under study with the flux generated by the T(d,n)^{4}He reaction; in the latter case, each neutron is accompanied by the emission of an α particle, thus making it possible to determine the neutron flux by means of an absolute α counting method. In media in which the slowing-down length is shorter than the diffusion length, it is possible to find a distance between the source and the thermal neutron detector at which the thermal neutron density is practically independent of the energy of the emitted neutrons and can be measured by its intensity. A 4-m diameter graphite sphere was used as such a medium. A ZrT_2 target was placed in the center of the sphere and bombarded through a horizontal channel with an accelerated D beam and with 14-Mev neutrons. The number of neutrons released was determined by measuring the α particles with a $^{10}BF_3$ counter. When measuring the neutrons from a Ra–Be source, the absorption within the source, the background of the counter, the multiplication of the neutrons in the target, the (d,d) reaction, and the varying sensitivity of the counters were taken into consideration. The mean square error was calculated at ±1.4%. (TTT)

26504 ABSOLUTE MEASUREMENT OF THE EFFICIENCY OF NEUTRON SOURCES BY THE MANGANESE ACTIVATION TECHNIQUE. A. A. Konstantinov, V. I. Fominykh, and I. A. Yaritsyna. At. Energ. (USSR), 16: 253-5(Mar. 1964). (In Russian)

The Mn activation method is based on the determination of the activity of ^{56}Mn, which is formed by placing a neutron source in the center of a large container filled with $MnSO_4$ solution. The resonance capture correction of neutrons by Mn may be calculated from the resonance escape probability; for the concentrations used, this correction was 0.009. The method was used to determine the absolute number of neutrons emitted by 2 Ra–Be sources. A cylindrical stainless-steel container was filled with $MnSO_4$ of exactly known concentration and the solution exposed to radiation from the source placed in the center for a period of 17 to 18 hours. The average ^{56}Mn activity was determined by means of a scintillation counter on the basis of the 845-kev γ-quanta, using a known Cs source for calibration. Corrections were made for the background, the decay up to the time of the measurement, the fast-neutron capture, the self-absorption of thermal neutrons and the neutron leakage. The average error of the measurements amounted to 1.3 to 1.5%. The results agreed well with those obtained by the associated particle method. (TTT)

26505 ABSOLUTE MEASUREMENT OF THE EFFICIENCY OF NEUTRON SOURCES BY THE GOLD-FOIL ACTIVATION METHOD. O. L. Andreev, A. E. Kochin, G. M. Stukov, and I. A. Yaritsyna. At. Energ. (USSR), 16: 255-6(Mar. 1964). (In Russian)

The widely employed Au-foil activation method requires the use of large amounts of a moderating material, mostly water, determining the thermal neutron distribution by means of a sensitive detector, and measuring the absolute β activity of Au foils placed in various locations. The absolute efficiency of the source can be calculated from these data. However, as the formulas derived are valid only for detectors which follow the $1/\gamma$ law and in the case of ^{197}Au, the cross section follows this law only up to 4.95 ev, the first resonance, the contribution of the resonance activity must be determined by using a Cd filter. The system used consisted of a cylindrical container with a diameter somewhat larger than 1 m, filled with distilled water to a height of 100 cm and containing the source in the center on a movable carriage. The Au foils used were 0.002 mm thick and a diameter of 20 mm; the Cd ratio was determined by means of a 0.5 mm thick Cd sheet. Three Au foils were suspended at distances between 3.5 and 9 cm from the source, exposing them for 8 days with and without the Cd sheet. The activity of the foils was determined on the basis of the $\beta-\gamma$ coincidences, making corrections for the self-shielding of the neutron flux, the shifting of the original neutron distribution in the moderator, the resonance absorption by Au, the absorption in the source itself, and the absorption of the fast neutrons by O. The mean square error of the measurements was 2.1%. (TTT)

26506 THE THEORY OF NON-STATIONARY DIFFUSION OF THERMAL NEUTRONS IN TWO-LAYER INFINITE MEDIUM WITH CYLINDRICAL BOUNDARY. A. L. Polyachenko (All-Union Scientific-Research Inst. of Nuclear Geophysics and Geochemistry, USSR). Izv. Akad. Nauk SSSR, Ser. Geofiz., No. 4, 532-47(Apr. 1964). (In Russian)

The theory of thermal neutron nonstationary diffusion was analyzed in relation to pulsed neutron logging. Explicit functions for thermal neutron distribution from a pulsed fast neutron source were constructed for a two-layer medium with cylindrical geometry. The behavior of a nonstationary field of fast neutrons in the inner cylinder and its relation to the external (strata) parameters was investigated. (R.V.J.)

26507 COLD NEUTRON INVESTIGATION OF THE STRUCTURE OF LIQUIDS. J. A. Janik (Inst. of Nuclear Physics, Krakow). J. Chim. Phys., 61: 97-104(Jan.-Feb. 1964).

A discussion of experimental techniques applied in neutron experiments with liquids is given. Results of total neutron scattering cross section measurements with liquids as well as those obtained from an analysis of scattered neutron spectra are interpreted in view of microdynamical features of liquids. 29 references. (auth)

26508 INVARIANT IMBEDDING THEORY OF NEUTRON TRANSPORT: CORRELATION FUNCTIONS. Richard Bellman, Robert Kalaba, and Ramabhadra Vasudevan (RAND Corp., Santa Monica, Calif.). J. Math. Anal. Appl., 8: 225-31(Apr. 1964).

Functional equations for correlation functions in both time and energy space are written directly for the reflected neutron fluxes, using the standard arguments of imbedding theory. Similar equations for the transmitted fluxes can also be written directly. (D.C.W.)

26509 SCATTERING OF SLOW NEUTRONS ON CRYSTALS AND FLUIDS. PART II. J. J. J. Kokkedee and B. R. A. Nijboer (Rijksuniversiteit, Utrecht). Ned. Tijdschr. Natuurk., 29: 93-109(Apr. 1963). (In Dutch)

The expressions for the incoherent and coherent cross sections for the scattering of slow neutrons on crystals considering the effect of exclusively harmonic forces between the atoms are given. These expressions were used to determine the phonon development, the effect on phonon interactions, and scattering of neutrons on fluids. (J.S.R.)

26510 NEUTRON SPECTRUM OF AN Am^{241}-Be(α,n) SOURCE. K. W. Geiger and C. K. Hargrove (National Research Council of Canada, Ottawa). Nucl. Phys., 53: 204-8(Apr. 1964).

The neutron energy spectrum of an alloyed ^{241}Am-Be(α,n) source was determined with a proton recoil spectrometer. The spectrum shows fairly broad maxima at 3.5 and 5 Mev and extends up to 11.5 Mev. This is similar to the published spectra of ^{210}Po-Be(α,n) sources. The partial neutron spectrum from the production of the 4.43-Mev state of ^{12}C was studied separately by a time-of-flight method; it is in fair agreement with calculated spectra. Absolute emission rate measurements on the source determine the fraction of neutrons below 1.5 Mev, where direct observation with the spectrometer is limited. This fraction was found to be 17% of the total neutrons emitted. The average neutron energy of the source spectrum was calculated to be 4.4 Mev. (auth)

26511 A FIRST-LAST COLLISION MODEL OF THE AIR/GROUND INTERFACE EFFECTS ON FAST-NEUTRON DISTRIBUTIONS. R. L. French (Radiation Research Associates, Inc., Fort Worth, Tex.). Nucl. Sci. Eng., 19: 151-7 (June 1964).

A method was developed for predicting the effect of an air/ground interface on the fast-neutron flux or dose at large distances from a point isotropic source of neutrons in air. The method yields numerical values for functions $f(H_S)$ and $f(H_D)$ that may be used to express the fast-neutron intensity as a function of source height H_S, receiver height H_D, and source-receiver separation distance R, in terms of the corresponding infinite air intensity I(R). Thus $I(H_S,H_D,R) = f(H_S)f(H_D)I(R)$. The method is called the First-Last Collision Model because it is based on the influence of the ground upon the distribution of first collisions of neutrons about the source and of last collisions about the receiver. Generalized numerical results were computed, and means were developed for applying these results to specific cases. Comparisons of these results with those derived from Monte Carlo calculations and from experiments performed at the ORNL Tower Shielding Facility and the Nevada Test Site indicate that the first-last collision model predicts the fraction of the infinite air intensity within 5 per cent in almost all cases. (auth)

26512 ACCELERATING CONVERGENCE OF DISCRETE-ORDINATES METHODS. J. H. Bennett (Westinghouse Electric Corp., Pittsburgh). Nucl. Sci. Eng., 19: 209-14(June 1964). (WAPD-T-1593)

Discrete-ordinates methods for the solution of the monoenergetic transport equation in infinite slab and infinite cylindrical geometry are considered. A numerical method for each geometry is defined, and successive over-relaxation schemes for accelerating the convergence of iterative solutions to each approximate equation system are illustrated. Numerical evidence is given to show that the successive overrelaxation schemes have a considerably higher rate of convergence than the standard Gauss-Jacobi iterative schemes. For the method for cylinders, the evidence shows also that the use of the acceleration technique results in a factor of at least 2.0 improvement in the actual time required to solve a range of problems to given accuracy. (auth)

26513 THE EFFECT OF CHEMICAL BINDING AND THERMAL MOTION ON A PULSE OF SLOWING DOWN

NEUTRONS. M. M. R. Williams (Brookhaven National Lab., Upton, N. Y.). Nucl. Sci. Eng., 19: 221-9(June 1964). (BNL-7405)

By associating the absorption cross section with the Laplace transform variable in the time domain, it is shown how Corngold's asymptotic solution for slowing down can be applied directly to the problem of a pulse of neutrons slowing down in an infinite medium. In this way, the effect of chemical binding and thermal motion on the slowing-down time, dispersion, and spectrum shape were determined. Some new results for these quantities were obtained, and the limitations of the asymptotic method were pointed out. A first-order correction to the slowing-down time was deduced for a finite medium large enough to be characterized by a DB^2 term. (auth)

26514 NEUTRON THERMALIZATION IN ZIRCONIUM HYDRIDE. J. C. Young, J. A. Young, G. K. Houghton, G. D. Trimble, and J. R. Beyster. Nucl. Sci. Eng., 19: 230-41 (June 1964).

A series of infinite-medium spectral measurements was performed on $ZrH_{1.75}$ at room temperature, 150, 170, 316, and 468°C, using a linear accelerator as a pulsed-neutron source. Two poison concentrations were used, 3.4 and 8 barns per hydrogen atom. These measurements clearly demonstrated that neutron spectra in zirconium hydride shift rather markedly with temperature. The above spectra were calculated theoretically assuming the hydrogen atoms to be bound in an isotropic harmonic potential and allowing for the possibility of accoustical vibrations in the zirconium hydride lattice. The agreement between theory and experiment is very good. (auth)

26515 AGE TO 1.44 ev FOR (D,D) NEUTRONS IN CONCRETE. B. Grimeland and S. Doenvold (Universitet, Oslo). Nucl. Sci. Eng., 19: 245-8(June 1964).

A deuterium (d,n) reaction was used as a source of neutrons to determine the neutron age in concrete. An activation technique was used in the measurements. The neutron age from 2.5 Mev to 1.44 ev was calculated for the concrete. (C.E.S.)

26516 RELATION OF THE NEUTRON DIFFUSION LENGTH TO NEUTRON-PULSE PARAMETERS IN H_2O. W. W. Clendenin (Westinghouse Electric Corp., Pittsburgh). Nucl. Sci. Eng., 19: 248-9(June 1964). (WAPD-T-1613)

The expression for the behavior of the time constant of a thermal neutron pulse was inverted to obtain an expression for the neutron diffusion length in water. Tables of the correction terms and diffusion lengths for the Nelkin model for water, the hardening of diffusion length eigenvalue scalar flux relative to Maxwell distribution, and macroscopic absorption cross sections averaged over the diffusion length eigenvalue spectrum and a Maxwell distribution are presented. (C.E.S.)

26517 ON THE ENERGY AVERAGING OF THE DIFFUSION COEFFICIENT. G. C. Pomraning (General Electric Co., Pleasanton, Calif.). Nucl. Sci. Eng., 19: 250-2(June 1964).

The problem of whether to use the diffusion coefficient or the reciprocal of the diffusion coefficient in an energy average of the diffusion coefficient for use in multigroup diffusion theory is discussed. (C.E.S.)

26518 GENERALIZATIONS OF FICK'S LAW. M. D. Kostin (Princeton Univ., N. J.). Nucl. Sci. Eng., 19: 252-4 (June 1964).

A generalization of Fick's law that uses the concept of neutron pressure for homogeneous isotropic media and slab geometries is derived. Examples are given to illustrate the simplicity and the wide range of validity of the method. (C.E.S.)

26519 SMALL-ANGLE ELASTIC SCATTERING OF NEUTRONS AND THE ELECTRIC POLARIZABILITY OF THE NEUTRON. D. B. Fossan and M. Walt (Lockheed Missiles and Space Co., Palo Alto, Calif.). Phys. Rev. Letters, 12: 672-4(June 15, 1964).

The differential cross section for neutron elastic scattering by uranium at 0.57 Mev was measured at 3 to 18°, and the contribution of the electric polarizability of the neutron to the cross section was studied. The results show that the small-angle cross section enhancement previously observed at higher energies does not occur so markedly at 0.57 Mev and is not due to an induced electric dipole moment in the neutron. (D.C.W.)

26520 DETERMINATION OF THE PHONON SPECTRUM FROM THE CROSS SECTION OF INCOHERENT SCATTERING OF NEUTRONS IN A CRYSTAL. B. D. Laikhtman (Semiconductor Inst., Leningrad). Soviet Phys.-Solid State (English Transl.), 5: 2222-3(Apr. 1964). (Translated from Fiz. Tverd. Tela, 5: 3036-7(Oct. 1963).

It is shown that, if the interaction of neutrons with any number of phonons is taken into account, the phonon distribution function may be constructed from the incoherent-scattering cross section in one crystal specimen. (M.J.T.)

26521 NEUTRON PROPAGATION IN BLOCKS OF NATURAL URANIUM AND NATURAL URANIUM–STEEL. C. Beets, J. L. Campan, P. Caumette, P. Colle, H. Deckers, A. Desprets, and C. P. Zaleski (CEN, Cadarache, France). p.277-98 of "Exponential and Critical Experiments. Vol. I." Vienna, International Atomic Energy Agency, 1964. (In French)

Neutron propagation in a block of natural uranium 40-cm thick and in a block of steel 100-cm thick jointed to the first was studied. The free face of the uranium block is submitted to a flux of thermal neutrons, which, in the first centimeters, give rise to a flux of fast neutrons. An attempt was made to measure the spatial and energy distributions of this flux. The measured results were compared with those obtained in a block of natural uranium 80-cm thick, and, using various methods, tried to obtain the spectra and the fluxes solely from an analysis of the experimental results. Parallel theoretical studies were made and the validity of the various methods of calculation and of the neutron constants employed was checked. A new exponential experiment is presented whose object is to determine the main parameters of the asymptotic spectrum in natural uranium and study the effects of introducing platelets of various materials. The experimental program is set out and the results of the preliminary calculations and of comparative calculations for the 80-cm block and the new block are commented upon. (auth)

Nuclear Properties and Reactions

26522 (ANL-6868(p.326-30)) NUCLEAR MAGNETIC RESONANCE RESEARCH AND MAGNETIC SUSCEPTIBILITY. (Argonne National Lab., Ill.).

Magnetic susceptibility and nuclear magnetic resonance of intermetallic compounds and solid solutions are measured and investigated. Nuclear magnetic resonance of aluminum-27 in $PuAl_2$ is reported along with the nuclear magnetic moments of neptunium-237 in neptunium oxide. (N.W.R.)

26523 (BNL-837(p.292-7)) MUON CAPTURE IN COMPLEX NUCLEI. Lincoln Wolfenstein (Carnegie Inst. of Tech., Pittsburgh).

Predictions of the universal Fermi interaction theory with conserved vector current for the values of the four coupling constants in muon capture are discussed. These theoretical results are compared with values from experiments: capture in hydrogen, comparisons between mu capture and beta decay, total capture rates, and three measurements sentitive to the induced pseudoscalar. (M.J.T.)

26524 (BNL-837(p.309-13)) EXPERIMENTAL CAPTURE RATE FOR MUONS IN He^4. M. M. Block, T. Kikuchi, D. Koetke, M. Schneeberger, C. R. Sun, R. Walker (Northwestern Univ., Evanston, Ill.); G. Culligan, V. L. Telegdi, and R. Winston (Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies).

The branching ratio of nuclear capture to decay of negative muons stopping in a liquid helium bubble chamber was measured. The capture rate is found to be 368 ± 46 sec^{-1}. (M.J.T.)

26525 (BNL-837(p.315-23)) RADIATIVE MUON CAPTURE IN Ca^{40} AND THE INDUCED PSEUDOSCALAR COUPLING CONSTANT. M. Conversi, R. Diebold, and L. di Lella (European Organization for Nuclear Research, Geneva).

A preliminary account is given of an experiment on the muon radiative capture process $\mu^- + p \rightarrow n + \nu_\mu + \gamma$, where p is a proton on a Ca^{40} nucleus. The induced pseudoscalar coupling constant, g_p, is determined from measurement of the reaction rate. (M.J.T.)

26526 (BNL-837(p.340-3)) SOME CONSEQUENCE OF THE CONSERVED VECTOR CURRENT THEORY IN FORBIDDEN BETA TRANSITIONS. Jun-Ichi Fujita (Washington. Univ., Seattle).

A theorem deduced from the conserved vector current hypothesis and giving the nuclear matrix element for the electric-dipole beta transition is stated in analogy to the Siegert theorem in electromagnetic transitions. The (p,n) resonance peak, E1 current exchange, and lepton-field expansion are discussed as consequences of the CVC theory. (M.J.T.)

26527 (BNL-837(p.454-6)) LIFETIME OF $_\Lambda H^3$: M. M. Block, R. Gessaroli, S. Ratti, M. Schneeberger (Northwestern Univ., Evanston, Ill.); L. Grimellini, T. Kikuchi, L. Lendinara, L. Monari (Bologna. Universita); W. Becker, and E. Harth (Syracuse Univ., N. Y.).

The lifetime of $^3_\Lambda H$'s found in the helium bubble chamber in the absorption reaction $K^- + {}^4He \rightarrow {}^3_\Lambda H + \pi^- + p$ was measured. The result differs from the theoretical estimate predicted with an impulse model. (M.J.T.)

26528 (BNL-7983) THE EXCITED STATES OF He^4. P. F. Donovan, J. V. Kane (Bell Telephone Labs., Inc., Murray Hill, N. J.; Brookhaven National Lab., Upton, N. Y.); J. F. Mollenauer, and P. D. Parker (Brookhaven National Lab., Upton, N. Y.). [nd]. Contract AT-30-2-GEN-16. 5p. (CONF-502-11)

From International Congress of Nuclear Physics, Paris, July 1964.

The reaction $D(^3He,p)^4He$ was used to investigate excited states in the ^4He nucleus. The decay of states populated by this reaction was studied using two semiconductor particle detectors and two-dimensional pulse-height analysis to examine coincidences between charged particles involved in the three-body breakups of the $D + {}^3He$ system. Two excited states in ^4He were identified in this way, one at an excitation of 19.99 ± 0.02 Mev with a width of 0.1 Mev and the other at an excitation of 21.2 ± 0.02 Mev with a width of 1.2 Mev. (auth)

26529 (BNL-8020) THE INDEPENDENCE HYPOTHESIS IN THE STATISTICAL THEORY OF NUCLEAR REACTIONS. T. J. Krieger (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract AT-30-2-GEN-16. 6p. (CONF-502-9)

From International Congress of Nuclear Physics, Paris, July 1964.

The independence of formation and decay of the compound nucleus system in the region of strongly overlapping resonances is investigated within the framework of R-matrix theory. Use is made of recently derived random sign rules based on the statistical distributions of reduced-width amplitudes and of resonance energies. The independence law, as expressed by the factored form of the partial reaction cross section, is shown to be asymptotically valid to terms of order $(\Gamma_{\lambda c}/D)^2$ in the limit $D/\Gamma \rightarrow 0$ and number of open channels very large. The results are expressed in a form manifestly covariant with respect to transformation of the angular momentum coupling scheme employed in designating the channels. (auth)

26530 (BNL-8028) MULTIPLE SCATTERING CORRECTIONS TO PARTIAL NEUTRON CROSS SECTION MEASUREMENTS. J. L. Friedes (Brookhaven National Lab., Upton, N. Y.). May 1964. Contract AT-30-2-GEN-16. 32p.

A Monte Carlo computer program for calculating the multiple-scattering corrections to the resonance absorption and scattering of neutrons in targets of finite thickness is described. (R.E.U.)

26531 (LADC-6007) INTERMEDIATE RESONANCE STRUCTURE IN THE CONTINUUM SHELL MODEL. 1. THEORY. J. E. Young (Los Alamos Scientific Lab., N. Mex.). [1963]. Contract W-7405-eng-36. 46p. (CONF-481-5)

From American Physical Society Annual Meeting, New York, Jan. 1964.

A discussion is given of the narrow resonances (~150 kev; $\langle D \rangle$ ~3 to 4 Mev^{-1}) seen in neutron scattering as a function of bombarding energy ($2 \text{ Mev} \lesssim E_n \lesssim 6$ Mev) throughout the periodic table. These resonances of the intermediate structure are described as originating in the coupling of states of 2 particles and 1 hole into states of a single particle, that of the incident projectile. The formal analysis provides a procedure for the extension of the intermediate coupling and configuration-mixing shell model into the continuum. Expressions are obtained for the positions and widths of the intermediate resonances. Some mention is made of the possible existence of other intermediate resonance structures. (auth)

26532 (NAA-SR-9418) ANALYSIS OF NEUTRON SCATTERING FROM SMALL VOLUMES OF CARBON, BERYLLIUM, ALUMINUM, IRON, AND POLYETHYLENE. R. S. Hubner (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Mar. 1, 1964. Contract AT(11-1)-Gen-8. 44p.

The results of the analyses of the ORNL Tower Shield experiments on neutron scattering from small volumes are presented and compared to the experimental data. Satisfactory agreement in the scattered dose is noted with both experiments and ORNL analytic methods. The calculated scattered spectra and n^{th} collision doses are presented. The Monte Carlo techniques used in the analysis are described. (auth)

26533 (NP-13974) EVIDENCIA ACERCA DE LA EXISTENCIA DEL DIPROTON O He^2 A TRAVES DE LA

REACCION $He^3(dt)He^2$. INFORME NO. 96. (Evidence for the Existence of Diprotons or He^2 Using the Reaction $He^3(d,t)He^2$. Report No. 96). O. M. Bilaniuk and R. J. Slobodrian (Argentina. Comisión Nacional de Energía Atómica, Buenos Aires). 1963. 17p.

The possible existence with finite lifetime of the diproton or ^{2}He was investigated using the reaction $^3He(d,t)^2He$ through the use of the 27-Mev external deuteron beam of the Buenos Aires synchrocyclotron. The diproton lifetime was obtained from the resulting discrete spectra as $\sim 2 \times 10^{-22}$ sec. The angular distribution of the long-lived product (triton) was measured between 8° and 51°3′ in the center-of-mass system, and fitted with a PWBA "pick-up" curve of $l = 0$ and $r_0 = 5.5$ fm. A reduced width value $\Theta^2 = 0.08$ was obtained from the latter, consistent with the values of other "pick-up" reactions. The experimental proof that the reaction proceeds via a two body process, not differing either qualitatively or quantitatively from other similar processes, as well as the measurement of the lifetime of the residual system of two protons, permits to state that the diproton does not differ substantially from other short-lived nuclei or nuclear states with lifetimes of the same order of magnitude. (auth)

26534 (ORNL-3582(p.16-17)) CORRELATION OF THE MÖSSBAUER ISOMER SHIFT WITH THE RESIDUAL ELECTRICAL RESISTANCE FOR GOLD ALLOYS. L. D. Roberts, R. L. Becker, F. E. Obenshain, and J. O. Thomson (Oak Ridge National Lab., Tenn.).

Measurements of the residual electrical resistance $\Delta\rho/c$ for gold alloyed in Cu, Ag, Pd, Pt, Ni, and Fe are given. A correlation of these $\Delta\rho/c$ values with the Mössbauer isomer shift is given through a simple model for the Cu, Ag, Pd, and Pt alloys. (auth)

26535 (ORNL-3582(p.20-3)) POLARIZATION OF TOTALLY REFLECTED MÖSSBAUER RADIATION. S. Bernstein and C. W. Nestor, Jr. (Oak Ridge National Lab., Tenn.).

A report is given of work on the reflection of ^{57}Fe Mössbauer radiation from an ^{57}Fe mirror as a function of (small) glancing angle and frequency of the source. This report describes the results of calculations of the effect of reflection on polarization and change of phase as a function of source frequency. (auth)

26536 (ORNL-3582(p.54)) COUPLED-CHANNEL CALCULATION OF THE SCATTERING OF 17.5 Mev PROTONS BY Ni^{62}. Taro Tamura (Oak Ridge National Lab., Tenn.).

Analysis of the scattering of protons by ^{62}Ni was made. (auth)

26537 (ORNL-3582(p.55)) ANALYSIS OF THE SCATTERING OF PROTONS BY Ho^{165} IN TERMS OF THE COUPLED-CHANNEL CALCULATION. Taro Tamura (Oak Ridge National Lab., Tenn.).

Scattering of 17.5 Mev protons by ^{165}Ho is analyzed theoretically. (auth)

26538 (ORNL-3582(p.56-7)) NUCLEAR RADII OF THE ISOTOPES OF TIN. J. A. Harvey and T. Fuketa (Oak Ridge National Lab., Tenn.).

The nuclear radii of the isotopes of tin have been obtained from transmission measurements from 0.1 to 2000 ev. (auth)

26539 (ORNL-3582(p.58-60)) PARAMETERS OF LOW ENERGY RESONANCES IN TUNGSTEN. D. Paya, K. D. Pearce, J. A. Harvey, and G. G. Slaughter (Oak Ridge National Lab., Tenn.).

Accurate parameters for 5 low-energy neutron resonances in tungsten have been determined from transmission measurements by area and shape analysis. (auth)

26540 (ORNL-3582(p.62-7)) GAMMA-RAY SPECTRA FROM NEUTRON CAPTURE IN THE ISOTOPES OF TIN. J. A. Harvey, G. G. Slaughter, J. R. Bird, and G. T. Chapman (Oak Ridge National Lab., Tenn.).

The gamma spectra from the capture of thermal and resonance neutrons in samples enriched in the tin isotopes have been studied. Many of the strong gamma rays are M1 transitions. (auth)

26541 (ORNL-3582(p.68-71)) GAMMA-RAY SPECTRA FROM RESONANT NEUTRON CAPTURE ON F^{19}. J. A. Biggerstaff, J. H. Gibbons, W. M. Good, and I. Bergqvist (Oak Ridge National Lab., Tenn.).

The resonant gamma spectra from 27- and 49-kev-neutron capture on ^{19}F are shown. Partial radiation widths are obtained. It is concluded that the E1 transitions in ^{20}F are weak compared with lighter nuclei. The ground state E1 does not behave in accord with Porter-Thomas; the weakness of this transition is not interpreted. (auth)

26542 (ORNL-3582(p.71-5)) RESONANT NEUTRON CAPTURE GAMMA-RAY SPECTRA FROM NUCLEI IN THE s-d SHELL. J. A. Biggerstaff, J. H. Gibbons, W. M. Good, and I. Bergqvist (Oak Ridge National Lab., Tenn.).

Resonant-neutron-capture gamma spectra are reported for neutron capture on ^{23}Na, ^{24}Mg, ^{27}Al, and ^{32}S. Resonances not previously observed in transmission are observed in the bombardment of ^{23}Na, ^{24}Mg, and ^{32}S. Further evidence is obtained that electromagnetic transitions in the odd-odd nuclei in the s-d shell show weakened E1 transitions, especially to states at and near ground. (auth)

26543 (ORNL-3582(p.75-82)) HIGH-RESOLUTION NEUTRON TOTAL CROSS SECTIONS. J. A. Biggerstaff, J. H. Gibbons, W. M. Good, R. L. Macklin, and P. Pasma (Oak Ridge National Lab., Tenn.).

The total cross section of kev-range neutron resonances in ^{32}S, ^{56}Fe, ^{206}Pb, ^{207}Pb, and ^{208}Pb have been investigated. Widths and probable l_n values are determined. These resonances, which generally have small neutron widths, are dominant features in the capture cross section. (auth)

26544 (ORNL-3582(p.82-4)) THE STRENGTH FUNCTIONS OF THE ISOTOPES OF ZIRCONIUM. J. A. Biggerstaff, W. M. Good, and H. Kim (Oak Ridge National Lab., Tenn.).

Total neutron cross sections are shown for the even isotopes of Zr. An area analysis of the principal resonances, which are judged from their appearance to be s-wave, yielded an average s-wave strength of $(1.3 \pm 0.4) \times 10^{-4}$. This result suggests that the Zr s-wave strength function is actually rather close to the prediction of the original cloudy-crystal ball model. (auth)

26545 (ORNL-3582(p.86-90)) THE INTERACTION OF NEUTRONS WITH Pb^{208}. J. L. Fowler (Oak Ridge National Lab., Tenn.).

Results are presented of a partial wave phase shift analysis of neutron scattering from ^{208}Pb. (auth)

26546 (ORNL-3582(p.90-2)) THE SCATTERING OF 3- TO 4-Mev NEUTRONS FROM O^{16}. J. L. Fowler and C. H. Johnson (Oak Ridge National Lab., Tenn.).

A phase shift analysis of the differential scattering cross sections shows that the resonance for 3.77-Mev neutrons is probably produced by d waves and that two broad overlapping $^3/_2^-$ and $^3/_2^+$ levels cause most of the increased cross section between 3 and 4 Mev. (auth)

26547 (ORNL-3582(p.93-4)) ELASTIC SCATTERING OF 17- TO 21-Mev NEUTRONS FROM C^{12}. M. V. Harlow,

Jr., R. L. Robinson, and B. B. Kinsey (Oak Ridge National Lab., Tenn.).

The differential elastic cross section and the total cross section of neutrons on ^{12}C have been measured. A resonance was observed at a neutron energy of 19.5 ± 0.20 Mev with a width of 1.2 Mev. (auth)

26548 (ORNL-3582(p.99)) ALPHA-ALPHA CORRELATIONS IN THE REACTION $Li^7 + d \rightarrow 2\alpha + n$. C. M. Jones, J. K. Bair, C. H. Johnson, and H. B. Willard (Oak Ridge National Lab., Tenn.).

The reaction $^7Li + d \rightarrow 2\alpha + n$ has been studied by simultaneously observing at different angles the two emitted alpha particles. (auth)

26549 (ORNL-3582(p.100-1)) He^3-INDUCED CHARGED-PARTICLE REACTIONS. P. D. Miller, J. L. Duggan, M. M. Duncan, V. H. Webb, W. R. Coker, and J. Lin (Oak Ridge National Lab., Tenn.).

The reactions $^9Be(^3He,p_{3\ to\ 19})^{11}B$, $^{14}C(^3He,\alpha_0)^{13}C$, and $^{14}C(^3He,d_0)^{15}N$ have been studied. (auth)

26550 (ORNL-3582(p.101-2)) THE $Mg^{24}(\alpha,\alpha)Mg^{24}$ AND $Mg^{24}(\alpha,\alpha')Mg^{24*}$ (2^+, 1.37 Mev) REACTIONS. H. J. Kim, L. A. Rayburn, C. D. Moak, and W. M. Good (Oak Ridge National Lab., Tenn.).

Angular distributions and absolute differential cross sections have been measured at the tandem accelerator for the elastic and inelastic (from 2^+, 1.37-Mev state) α-particle scattering from a thin (~200 $\mu g/cm^2$) ^{24}Mg target. Measurements were made at 100 and 200 kev intervals for α energies from 18 to 21.4 Mev. (auth)

26551 (ORNL-3582(p.107-11)) COULOMB EXCITATION OF VIBRATIONAL TRIPLET STATES AND OCTUPOLE STATES IN THE EVEN CADMIUM NUCLEI. F. K. McGowan, R. L. Robinsin, P. H. Stelson, J. L. C. Ford, and W. T. Milner (Oak Ridge National Lab., Tenn.).

A discussion is given of the results obtained from Coulomb excitation of nuclear states in the isotopes of cadmium with ^{16}O ions. (auth)

26552 (ORNL-3582(p.112-14)) COULOMB EXCITATION OF Br^{81} WITH ALPHA PARTICLES. R. L. Robinson, F. K. McGowan, and P. H. Stelson (Oak Ridge National Lab., Tenn.).

Level properties of the 276-, 559-, 769-, and 834-kev levels of ^{81}Br have been investigated by means of Coulomb excitation with 2.5- to 7-Mev alpha particles. (auth)

26553 (ORNL-3582(p.115-17)) CONVERSION ELECTRONS FROM NUCLEAR STATES OF INDIUM EXCITED BY (p,n) REACTIONS. E. C. Campbell and P. F. Fettweis (Oak Ridge National Lab., Tenn.).

Measurements of the internal conversion spectra lead to the conclusion that the second excited states of ^{114}In and ^{116}In both decay by E3 transition. (auth)

26554 (ORNL-3582(p.121-6)) FISSION OF ORIENTED NUCLEI. J. W. T. Dabbs, F. J. Walter, and G. W. Parker (Oak Ridge National Lab., Tenn.).

Anisotropy variations with energy appear to be directly related to contributions of the two possible J values. (auth)

26555 (ORNL-3582(p.130)) WAVE FUNCTIONS FOR MUON CAPTURE IN THE HYDROGEN Mu-MOLECULAR ION. R. L. Becker (Oak Ridge National Lab., Tenn.).

In order to determine the coupling constants for the muon capture interaction from experimental capture rates in liquid hydrogen, an accurate muon wave function in the $p \rightarrow \mu - p$ molecule is needed. A calculation is described. (auth)

26556 (ORNL-TM-875) HAUSER-FESHBACH COMPUTER PROGRAM FOR SPIN-½ PARTICLES. William R. Smith (Oak Ridge National Lab., Tenn.). May 25, 1964. Contract W-7405-eng-26. 5p.

The CDC-1604 binary program described computes neutron and proton inelastic-scattering angular distributions and integrated cross sections if the necessary penetrabilities and level spins and parities are provided. The program is not restricted with respect to the spins of the states involved, but it will treat simultaneously a maximum of only 30 states. It computes answers for all the inelastic states involved. Several tabulations of optical model penetrabilities to use with this program are available. (auth)

26557 (PAN-481/I) SUR LE MECANISME DE LA TRIPARTITION. (On the Mechanism of Tripartition). Jan. Turkiewicz (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Dec. 1963. 6p.

The model of Tsien is noted to give an incomplete account of the dependence of the angular distribution of the alpha particles on their energy in the ternary fission of ^{235}U. A model which explains the experimental observations and their difference for ^{235}U and ^{239}Pu (for which the Tsien model is valid) is outlined. (D.C.W.)

26558 (UCRL-11377) ENERGY-MASS DISTRIBUTIONS IN INDUCED FISSION. F. Plasil, D. S. Burnett, and S. G. Thompson (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 1964. Contract W-7405-eng-48. 6p. (CONF-502-12)

From International Congress of Nuclear Physics, Paris, July 1964.

Measurements of the energy and mass distributions of fission fragments produced by the bombardment of a number of relatively light elements with heavy ions and alpha particles are presented. The results were interpreted in terms of an approximate version of the liquid drop model, which applies to this region of elements. The energies of both fission fragments from every event considered were measured with solid-state detectors, recorded in a correlated manner, and transformed to give mass-total kinetic energy density-of-events distributions. In some cases, data at several bombarding energies were obtained. Comparisons with liquid drop calculations were made and good agreement was found in the gross features of the distributions, and in the nuclear temperature dependence of the widths. (auth)

26559 (WASH-1047) COMPILATION OF REQUESTS FOR NUCLEAR CROSS SECTION MEASUREMENTS. A. B. Smith, comp. (Argonne National Lab., Ill.). Feb. 1964. Contract [W-31-109-eng-38]. 91p. (EANDC (US)-53)

The procedures in requesting nuclear cross section data from the USAEC Nuclear Cross Section Advisory Group are discussed. Tables are presented for differential cross sections for neutron elastic and inelastic scattering, total and capture cross sections for fast neutrons, thermal cross sections, resonance parameters and radiative cross sections, and fission cross sections. (R.E.U.)

26560 INTERACTIONS ON THE IMPURITIES OF A VANADIUM TARGET BOMBARDED WITH DEUTERONS OF ENERGIES BETWEEN 8.0 and 10.5 Mev. J. Catalá, A. García, and J. M. Bolta (Facultad de Ciencias, Valencia). Anales Real Soc. Espan. Fis. Quim. (Madrid), Ser. A, 59: 127-32(July-Aug. 1963). (In Spanish)

Impurities were determined in a thin vanadium target bombarded with 8.0 to 10.5 Mev deuterons. In addition to an important contribution of oxygen previously studied, groups arising from elastic scattering by C and Hg were noticed on a broad angular range, and the corresponding differential cross sections and angular distributions in the center-of-mass system were measured. (auth)

26561 ELASTIC SCATTERING OF DEUTERONS OF 10 Mev ON VARIOUS NUCLEI (C, O, Mg, ETC.). J. Catalá, A. García, and J. M. Bolta (Facultad de Ciencias, Valencia). Anales Real Soc. Espan. Fis. Quim. (Madrid), Ser. A, 59: 133-42(July-Aug. 1963). (In Spanish)

The elastic scattering of 10-Mev deuterons by several nuclei (C, O, Mg, etc.) was studied with a multichannel magnetic spectrograph. The black disk interaction radii were calculated for the light nuclei present, and the experimental angular distributions for ^{12}C, ^{16}O, ^{25}Mg, and ^{181}Ta were compared with preliminary calculations based on the optical model. (auth)

26562 STRONG ABSORPTION MODEL FOR ELASTIC NUCLEAR SCATTERING AND POLARIZATION OF SPIN-½ PARTICLES. PART II. R. H. Venter and W. E. Frahn (Univ. of Stellenbosch, Cape Province, South Africa). Ann. Phys. (N. Y.), 27: 385-400(May 1964).

A simplified version of the strong absorption model for elastic nuclear scattering of spin-½ particles is applied in an analysis of the 180-Mev proton data of the Uppsala group. Satisfactory simultaneous fits of the differential elastic scattering cross section $\sigma(\theta)$, the polarization $P(\theta)$ and the total reaction cross section σ_r for Li, Be, C, Al, Ca, Fe, In, and Au are obtained with a single set of the five parameters of the model. By slight changes of this standard set of parameters for individual nuclei, the data of $\sigma(\theta)$ and $P(\theta)$ can be represented with an accuracy which is in several respects superior to the best fit obtained from a seven-parameter complex potential model analysis. (auth)

26563 STRONG ABSORPTION MODEL FOR ELASTIC NUCLEAR SCATTERING AND POLARIZATION OF SPIN-½ PARTICLES. PART III. R. H. Venter and W. E. Frahn (Univ. of Stellenbosch, Cape Province, South Africa). Ann. Phys. (N. Y.), 27: 401-24(May 1964).

The generalized strong-absorption model is applied to the elastic scattering of alpha particles, ^3He, and heavy ions. Based on the analytical formulas obtained for the differential scattering cross sections, simple methods of analysis are described which greatly facilitate the extraction of parameter values from the experimental angular and energy distributions. By these methods, most of the existing data on alpha particle, ^3He, and heavy ion scattering are analyzed. It is shown that a simplified, three-parameter version of the general model is sufficient to represent these data. The values of the radius parameter r_0, the diffuseness parameter d, and the real phase parameter $\mu/4\Delta$ resulting from the analysis of 43 ^4He, 12 ^3He, and 28 heavy ion angular distributions, and of 46 ^4He energy distributions are presented. To illustrate the quality of the fits obtained, complete angular and energy distributions are shown for several typical cases. (auth)

26564 ELECTRODYNAMIC PROCESSES WITH NUCLEAR TARGETS. S. D. Drell and J. D. Walecka (Stanford Univ., Calif.). Ann. Phys. (N. Y.), 28: 18-33(June 5, 1964).

It is known that two general form factors depending on energy loss and momentum transfer characterize inelastic electron scattering from nuclei in the first Born approximation in $\alpha = 1/137$. The same two form factors appear in all electrodynamic processes connected by one-photon exchange with nuclei. This observation is used to compute cross sections and to discuss experiments which are aimed at probing electrodynamics by scattering or pair producing electrons or muons from nuclear targets. (auth)

26565 POSITRON BRANCHING RATIOS IN THE DECAYS OF F^{17}, Na^{21}, Al^{25}, AND Al^{26m}. S. E. Arnell and E. Wernbom (Chalmers Tekniska Högskola, Goteborg). Arkiv Fysik, 25: 389-96(1964).

Positron branching or upper limit for branching was studied in the following decays: $^{17}F(\beta^+)^{17}O$, $^{21}Na(\beta^+)^{21}Ne$, $^{25}Al(\beta^+)^{25}Mg$, and $^{26m}Al(\beta^+)^{26}Mg$. (auth)

26566 ON THE LEVEL SCHEME OF Tb^{155}. Lars Persson and Hans Ryde (Nobel Inst. of Physics, Stockholm). Arkiv Fysik, 25: 397-415(1964).

The 10.2 h decay of ^{155}Dy to the odd-proton nucleus ^{155}Tb was investigated using magnetic beta spectrometers and scintillation detectors. Gamma-gamma and electron-gamma coincidence experiments were performed to study the coincidence relations. The ^{155}Dy source was produced by a (p,5n) reaction on the stable isotope ^{159}Tb. By ion-exchange chromatography the dysprosium fraction was isolated from the neighboring rare earths. The mass assignment of the activity investigated was confirmed by electromagnetic isotope separation. In the internal conversion spectrum electron lines interpreted as due to transitions having the energies 181, 185, 389, 433, 451, 461, 484, 498, 508, 550, 587, 642, 654, 664, 723, 745, 761, 813, 837, 844, 892, 905, 929, 1000, 1091, 1155, 1164, 1250, and 1450 kev were observed in addition to the electron lines earlier assigned to the decay of ^{155}Dy. The relative intensities of the internal conversion lines are deduced from the measurement with the beta ray spectrometer. A tentative resolution of the gamma ray spectrum recorded with a NaI(Tl) detector was performed giving mostly upper limits for the gamma ray intensities. From the gamma ray spectrum transitions having the energies 1385 and 1665 kev are also inferred. A tentative level scheme of ^{155}Tb was deduced from the results of the coincidence, sum-coincidence, and well-crystal measurements and from the energy relations of the transitions found. Thus levels at 616, 653, 706, 761, 811, 879, 891, 1156, 1318, 1389, and 1665 kev are suggested in addition to the previously known states in ^{155}Tb at 65, 156, 227, and 271 kev. The assignments and the characters of the suggested levels are discussed in terms of the unified nuclear model. (auth)

26567 EXPERIMENTAL STUDIES OF QUASI-FREE PROTON-PROTON SCATTERING IN LIGHT NUCLEI. G. Tibell, O. Sundberg, and P. U. Renberg (Uppsala Univ.). Arkiv Fysik, 25: 433-61(1964).

The (p,2p) reactions in ten light nuclei, from ^6Li to ^{40}Ca, bombarded with 185 Mev protons, were studied. An energy resolution of 3.2 Mev full width at half height was obtained in the summed-energy spectra. Range telescopes were used to determine the energies of the outgoing protons. Preliminary results for ^6Li, ^7Li, and ^{40}Ca appeared. The binding energies corresponding to peaks in the summed-energy spectra were determined. By varying the angle of observation in the geometrically symmetric setup it was possible to obtain angular correlation distributions giving information on the properties of the shell model states involved in the reaction. The comparatively sharp energy resolution made it possible to get rather detailed information on the summed-energy spectra for the p-shell nuclei studied (^6Li, ^7Li, ^9Be, ^{10}B, and ^{11}B). In the region where the 1d and 2s-shells are being filled, five nuclei were studied: ^{24}Mg, ^{27}Al, ^{28}Si, ^{31}P, and ^{40}Ca. A table of previous reported values of the binding energies corresponding to peaks in summed-energy spectra for sixteen light nuclei is given. (auth)

26568 SCATTERING OF 0.5- AND 0.8-Mev NEUTRONS ON INTERMEDIATE AND HEAVY NUCLEI. M. V. Pasechnik, V. A. Batalin, I. A. Korzh, and I. A. Totskiĭ. At. Energ. (USSR), 16: 207-11(Mar. 1964). (In Russian)

The design of epithermal and fast reactors requires the knowledge of the cross section and angular distribution of the elastically scattered neutrons in a wide energy range. As a contribution to the problem, the differential elastic scattering cross sections of 0.5 and 0.8-Mev neutrons by Fe, Zn, Zr, Cd, Sn, Ba, Hg, Pb, Bi, and U were measured at angles from 30 to 140°. The spherical scatterers used in the experiments presented the advantage that effects due to the asymmetry of the source are eliminated and corrections for multiple scattering can be applied more conveniently. From the experimental data, the mean cosine of the elastic scattering angle, the transport cross section of the elastically scattered neutrons and the same value calculated under consideration of the inelastically scattered neutrons were tabulated. The results indicated that the neutron scattering is anisotropic process at both energy levels. In the case of Fe and Zn, a slight increase of the cross section was noted at the low-angle range and also at high angles for 0.8-Mev neutrons. At both energy levels, the heavy nuclei Zr, Cd, Sn, Bi, Ba, Hg, Pb, and U exhibited a sharp maximum in the angular distribution curve. The anisotropy in the angular distribution of Ba, Hg, Pb, Bi, and U became more pronounced upon passage from 0.5 to 0.8 Mev. (TTT)

26569 INTERFERENCE EFFECTS IN FISSION CROSS SECTIONS. I. V. Kirpichnikov, K. G. Ignat'ev, and S. I. Sukhoruchkin. At. Energ. (USSR), 16: 211-18(Mar. 1964). (In Russian)

An interference analysis of the fissioning of ^{235}U and ^{239}Pu isotopes by slow neutrons was carried out, using the results of η and total cross section measurements with a pulsed-beam neutron spectrometer (Atomnaya Energ., 16: 114(1964)). Employment of the analytical method developed by E. Vogt (Phys. Rev., 112: 203(1958)) yielded good agreement with analytical data. The relative sign of the interference phases was determined in most cases on the basis of the energy dependence of η; the degree of interference, the absolute value of the phase, was estimated by means of an approximation formula. It was found that consideration of interference effects changes only slightly the value of level parameters, as compared to values obtained by other methods; therefore the phase analysis of the interference was emphasized. The correlation in the amplitude signs (phases) of the level widths cannot be explained by the currently accepted models of the nucleus. The number of the effectively open fission channels was found to be close to 1 for ^{239}Pu and close to 2 for ^{235}U. (TTT)

26570 THE CAPTURE CROSS SECTION OF THE Cr, ^{50}Cr, ^{52}Cr AND ^{53}Cr NUCLEI FOR NEUTRONS WITH ENERGIES UP TO 50 kev. S. P. Kapchigashev and Yu. P. Popov. At. Energ. (USSR), 16: 256-8(Mar. 1964). (In Russian)

The energy dependence of the radiative capture cross section of neutrons with energies up to 50 kev by the natural isotopic mixture of Cr and by the isotopes $^{50,52,53}Cr$ were determined, measuring the slowing-down time of the neutrons in Pb. The spectrometer used in the study had a resolution of about 30% in the $E \leq 1$ kev range and about 70% at $E = 15$ kev. Scintillation and proportional counters were employed for detecting the capture γ radiation. It was found that no self-shielding occurs with the natural mixture; this could not be verified with the enriched isotopes because of the small amounts available for the study. The obtained radiative-capture cross sections of natural Cr at $E \geq 30$ kev agreed well with the previously reported data; the total absorption resonance integral was determined with a higher precision than before. For ^{50}Cr, at the $E < 11$ kev range, the previously found strong resonance integral with $E = 6.6$ kev was shifted toward the smaller energy range. It was assumed that at this range ^{50}Cr has a group of levels ($n \geq 2$). The 1.7-kev level of ^{52}Cr was subject to neutron capture; ^{53}Cr exhibited a wide peak at 327 ± 36 barns in the 4 to 8 kev range. In view of the very low capture cross section of ^{54}Cr, only the upper limit of the resonance integral was indicated. (TTT)

26571 SCATTERING OF 0.5- TO 0.8-Mev NEUTRONS ON LIGHT AND INTERMEDIATE NUCLEI. I. A. Korzh, N. S. Kopytin, M. V. Pasechnik, N. M. Pravdivyi, N. T. Sklyar, and I. A. Totskiĭ. At. Energ. (USSR), 16: 260-2 (Mar. 1964). (In Russian)

The method previously employed for measuring the angular distribution of 0.5- to 0.8-Mev neutrons (Atomnaya Energ., 16: 207(1964)) was used for studying the scattering of neutrons of the same energy on C, Na, Mg, Al, Ni, Cu, Se, and Te nuclei. A threshold detector was employed to exclude the inelastically scattered neutrons. The measurements were carried out at 80 different angles between 30 and 140° with an energy resolution of ±50 kev. In calculation of the different elastic scattering, the lack of uniformity of the neutron flux was taken into consideration; corrections were also made for variations of the detector efficiency as the function of the neutron energy in the case of multiple elastic collisions. The angular distribution of the elastically scattered neutrons indicated that the scattering is anisotropic in both cases examined, confirming the predictions of the optical model of the nucleus. A slight rise was observed at 0.8 Mev in the case of C, Na, Al, Ni, and Cu and at 0.5 Mev in the case of Mg, Se, and Te in the low-angle range. The anisotropy of the angular distribution increased for the nuclei studied upon passing from 0.5 to 0.8 Mev. (TTT)

26572 NUCLEAR ENERGY—WHAT IT IS AND HOW IT ACTS. PART 15. FURTHER ASPECTS OF INTERACTIONS BETWEEN PARTICLES AND ATOMIC NUCLEI. THE FISSION REACTION; ITS IMPORTANCE IN THE PRACTICAL APPLICATION OF NUCLEAR ENERGY. PRELIMINARY CONSIDERATIONS OF NUCLEAR STRUCTURE; NATURE OF NUCLEAR FORCES. Andrew W. Kramer. Atomics, 17: No. 3, 38-44(May-June 1964).

Consideration is given to the fission reaction, which effects major nuclear changes and one that is of inestimable practical, commercial, as well as social and political significance. The reaction is based on a very special type of nuclear transformation, possible only in very heavy nuclei. The saturation of nuclear density and the binding energy requires that nuclear forces be of short range compared with electrostatic forces and that there is considerable evidence in favor of the simple hypothesis that the basic law of force is the same for any two nucleons. Aside from the minor differences attributable to electrostatic effects, the energies of the first few excited states are almost identical in each pair of mirror nuclei. In other words, the replacement of a proton by a neutron has little or no effect on the nuclear forces. (P.C.H.)

26573 RAPID ANALYSIS OF TWO-COMPONENT SUBSTANCES AFTER ATTENUATION OF RADIOACTIVE RADIATION. W. Dietzsch (VEB Vakutronik, Dresden). Atompraxis, 10: 181-4(Apr. 1964). (In German)

The linear attenuation coefficient of a given substance depends upon the composition of the substance. Thus it is possible to determine the latter by measuring the attenuation of radioactive radiation when it passes through the substance. Changes that occur when the mass attenuation coefficients are unequal are discussed. (P.C.H.)

26574 A NEW ENERGY LEVEL IN ^{20}Ne AT 10.31 Mev. D. G. Sargood and G. D. Putt (Univ. of Melbourne). Australian J. Phys., 17: 56-62(Mar. 1964).

Neutron–gamma coincidence measurements were made in the reaction ^{19}F(d,nγ)^{20}Ne at bombarding energies between 500 and 700 kev. Time-of-flight determination of neutron energy indicates a new energy level in ^{20}Ne at 10.31 ± 0.07 Mev. From angular distributions of the neutrons, the observation of the gamma-decay spectrum of the 10.31-Mev state, spin and parity of 1^+ are inferred for this state. (auth)

26575 ISOTOPE SHIFT IN BARIUM. F. M. Kelly and E. Tomchuk (Univ. of Manitoba, Winnipeg, Can.). Can. J. Phys., 42: 918-25(May 1964).

Isotope shifts and magnetic hyperfine structures for lines in the first and second spectra of barium are reported and compared with previous results in an attempt to remove anomalies. The unusual order of the barium isotopes in the Ba I resonance line was partially confirmed by observations on Ba II. (auth)

26576 SOME NEW NEUTRON SEPARATION ENERGIES FOR ISOTOPES OF Hg, Tl, Pb, AND Bi. W. McLatchie, R. C. Barber, R. L. Bishop, H. E. Duckworth, B. G. Hogg, J. D. Macdougall, and P. Van Rookhuyzen (McMaster Univ., Hamilton, Ont.). Can. J. Phys., 42: 926-36(May 1964).

Values derived from mass spectral doublets are reported for the following mass differences: ^{200}Hg–^{198}Hg, ^{201}Hg–^{198}Hg, ^{202}Hg–^{200}Hg, ^{204}Hg–^{202}Hg, ^{205}Tl–^{203}Tl, ^{206}Pb–^{204}Pb, ^{208}Pb–^{206}Pb, ^{209}Bi–^{207}Pb, ^{207}Pb–^{205}Tl, ^{206}Pb–^{204}Hg, and ^{203}Tl–^{201}Hg. These mass differences are combined with existing reaction and disintegration data to yield single- and double-neutron separation energies for several of the isotopes of the above elements. The resulting neutron separation energy curves for even N are strikingly similar in shape; all exhibit an abrupt change in slope at N = 124. The curves for odd N do not display the same regularity. Currently accepted values for the total decay energies ^{204}Tl–^{204}Hg and ^{202}Tl–^{202}Hg are probably too large and too small, respectively, but current values for ^{205}Pb–^{205}Tl and ^{209}Bi–^{208}Pb are confirmed. (auth)

26577 NEUTRON TOTAL CROSS SECTION OF PRASEODYMIUM AT 14 Mev. Yuin Chi Hsu, Chia Yi Huang, and Yuin Kwei Tai (National Taiwan Univ., Taipei). Chinese J. Phys. (Taiwan), 1: 39-41(Oct. 1963).

The neutron total cross section of praseodymium was measured using the T(d,n)^{4}He reaction as a source of 14-Mev neutrons. Measurements were made with a good geometry arrangement. The neutron detector used was a plastic scintillator of 1 in. × 1 in. ϕ. The neutron total cross section of praseodymium at a neutron energy of 13.95 ± 0.03 Mev was found to be 5.11 ± 0.15 b. (auth)

26578 ANGULAR MOMENTUM DISTRIBUTIONS IN THE THOMAS-FERMI MODEL. Jenn-lin Hwang (National Taiwan Univ., Taipei). Chinese J. Phys. (Taiwan), 1: 74-80(Oct. 1963).

The problem of how many nucleons of a given orbital angular momentum l$\hbar$ are to be found in a nucleus of a given atomic number Z is reexamined. The sources of errors inherent to this problem are indicated, including the arbitrariness in selecting the manner of angular momentum assignment. It is further shown that the problem is essentially equivalent to the evaluation of a WKB integral if the exact result is to be obtained. The maximum energy $(E_l)_{max}$ of a given angular momentum state l should be determined as an eigenvalue. In this sense the present treatment strictly considers the quantized nature of angular momentum. Two hypothetical models of nuclei with an average potential of the harmonic oscillator and of the square well obeying the previously reported rules of nuclear radii are treated both by an improved method and the original Fermi's method. The results are compared with the exact values to show the superiority of the new method. (auth)

26579 INTERPRETATION OF 5^- LEVELS IN EVEN-EVEN NUCLEI. S. M. Brahmavar and M. K. Ramaswamy (Karnatak Univ., Dharwar, India). Current Sci. (India), 33: 107-8(Feb. 20, 1964).

An examination of 2^+, 3^-, and 5^- levels in some even-even nuclei indicates that the 5^- levels can be interpreted as collective vibrations of the $\lambda = 5$ mode, not as the result of coupling of 2^+ and 3^- levels as suggested by Broek for Ni and Zn isotopes. (D.C.W.)

26580 ON THE MIXING RATIOS (M_1-E_2) IN SOME EVEN-EVEN NUCLEI. S. M. Brahmavar and M. K. Ramaswamy (Karnatak Univ., Dharwar, India). Current Sci. (India), 32: 351-3(Aug. 1963).

The predictions of the single-particle model and the Davydov and Filippov model for the mixing ratio of the $2' \rightarrow 2$ transition of even-even nuclei are compared with each other and with experimental values. (D.C.W.)

26581 EFFECTS OF NUCLEAR STRUCTURE ON THE FORMATION OF INTERNAL PAIRS. Roland Lombard (Swiss Federal Inst. of Tech., Zurich). Helv. Phys. Acta, 37: 3-29(1964). (In German)

The theory of internal pair formation was studied for electric dipole transitions. Several spectra were calculated in the Coulomb approximation in order to investigate the variation of the spectrum shape as a function of the nuclear charge Z and the transition energy k. It is shown that the influence of electronic shells on internal pair formation can be neglected. An attempt was made to see under what conditions nuclear structure effects may be detected in internal pair formation. The results were similar to those obtained in case of internal conversion. Two transitions were analyzed in ^{206}Pb and ^{144}Nd. There was no experimental evidence for nuclear structure effects in these transitions. ^{206}Pb showed a rather fast E1 character. In case of ^{144}Nd a more precise determination of the total pair formation coefficient was desirable. Further experiments are suggested, especially in the region of deformed nuclei. (auth)

26582 (p,p,γ) ANGULAR CORRELATIONS AT 5.8 Mev ON ^{64,66,68}Zn. Roland Szostak and Bruno Gobbi (Eidgenössische Technische Hochschule, Zurich). Helv. Phys. Acta, 37: 30-54(1964). (In German)

At a proton energy of 5.8 Mev, angular correlations were measured between inelastically scattered protons and subsequently emitted γ rays from the first excited state in ^{64}Zn, ^{66}Zn, and ^{68}Zn for azimuthal angles $\phi = 0$ and π at proton angles $\vartheta_{p'} = 45$, 90, and 135° as a function of the γ angle between 0° and 156°. The isotopes ^{64}Zn and ^{66}Zn showed very similar behavior; from comparison of the experimental data with predictions of statistical theory it was concluded that the reaction proceeds mostly by way of compound nucleus formation with a small admixture of direct interaction at forward scattering angles. For ^{68}Zn, however, the direct reaction predominated and cross sections in this case were one order of magnitude smaller than those for ^{64}Zn and ^{66}Zn. This different behavior for ^{68}Zn might arise from the low (p,n) threshold. The neutron exit channel thereby represents a competing decay mode to the inelastic proton scattering. (auth)

26583 RADIONUCLIDE PRODUCTIONS IN THICK IRON TARGETS BOMBARDED WITH 1- AND 3-Gev PROTONS. J. P. Shedlovsky and G. V. S. Rayudu (Carnegie

Inst. of Tech., Pittsburgh). J. Geophys. Res., 69: 2231-42(June 1, 1964).

The effective production cross sections of a number of radionuclides were measured. The low-energy products ^{54}Mn, ^{51}Cr, and ^{48}V show varying buildup factors near the front of the target; the high-energy products ^{7}Be, ^{24}Na, and ^{32}P show little, if any, buildup. The buildup factors are larger in the 3-Bev target and extend to greater depths. All the production cross sections eventually decrease exponentially with depth, corresponding to mean absorption lengths along the primary beam of ~65 and 125 g cm^{-2} at 1 and 3 Bev, respectively. The radial distribution of the products was measured, and contours of constant concentration were determined. The radial spreading becomes very significant for low-energy products near the back of the targets, whereas high-energy products are fairly well collimated along the beam axis. The results of the 3-Bev experiment are in good agreement with those reported by Honda in 1962. (auth)

26584 SPALLATION PRODUCTS PRODUCED BY BOMBARDMENT OF DYSPROSIUM WITH PROTONS OF ENERGIES 9–87 Mev. M. May and L. Yaffe (McGill Univ., Montreal). J. Inorg. Nucl. Chem., 26: 479-90(Apr. 1964).

Natural dysprosium and dysprosium enriched in various isotopes were bombarded with protons of energies between 9 and 87 Mev. Mass assignments of holmium and dysprosium activities were verified, as well as half lives and γ ray assignments. An α emitter with half life 27 min was assigned to ^{153}Ho. Cross sections of natural dysprosium for production of various spallation products were determined. Formation cross sections from some individual dysprosium isotopes were obtained by comparison of enriched isotopic and natural dysprosium bombardments. The cross sections showed reasonable agreement with those predicted by the Jackson model. (auth)

26585 RELATIVE CROSS-SECTIONS FOR FORMATION OF THE SHIELDED ISOMERIC PAIR ^{134m}Cs AND ^{134}Cs IN MEDIUM ENERGY FISSION. H. Warhanek (Argonne National Lab., Ill. and Institut für Radiumforschung und Kernphysik, Vienna) and R. Vandenbosch. J. Inorg. Nucl. Chem., 26: 669-76(May 1964).

The cross-section ratio of ^{134}Cs and ^{134m}Cs was measured for fission of ^{233}U, ^{235}U, and ^{238}U induced by He ions of 27 to 42 Mev, for fission of ^{237}Np induced by deuterons of 21 Mev and for fission of ^{233}U induced by γ rays with an energy of up to 16 Mev. Comparison of the results with calculations based on a statistical theory of the spin distribution of level densities in excited nuclei shows that in the case of low angular momentum of the fissioning nucleus (γ induced fission) the fragments are produced with a mean intrinsic angular momentum, which is larger than the angular momentum of the fissioning nucleus. The isomer ratio results also show that when the angular momentum of the fissioning nucleus is increased (He-ion-induced) this is at least partially transferred into additional intrinsic angular momentum of the fragment. Measurements of the angular dependence of the isomer ratio revealed no significant differences between the isomer ratio at 90 and at 170°C. The half life of ^{134m}Cs was remeasured and found to be 2.91 ± 0.02 hr in agreement with earlier results. (auth)

26586 β-SPECTRUM OF ^{32}Si. R. L. Brodzinski, J. R. Finkel, and D. C. Conway (Purdue Univ., Lafayette, Ind.). J. Inorg. Nucl. Chem., 26: 677-81(May 1964).

The endpoint energy of 100 disintegration/min of ^{32}Si as Si*$(C_2H_5)_4$ was found to be 213 ± 7 kev by means of a liquid scintillation spectrometer. The log ft for the allowed, 1 forbidden transition is 8.2. (auth)

26587 SYSTEMATIC CHARACTERIZATION OF mTH-ORDER ENERGY-LEVEL SPACING DISTRIBUTIONS. Harvey S. Leff (State Univ. of Iowa, Iowa City). J. Math. Phys. (N. Y.), 5: 756-62(June 1964).

The mth-order energy-level spacing distributions $p^{(m)}(x)$ for complex spectra are defined in terms of a general joint probability distribution $P_N(\lambda_1, \cdots \lambda_N)$ for N consecutive eigenvalues. The precise limiting processes involved are explained, and are subsequently used to obtain two formal representations of $p^{(m)}(x)$. Both representations yield $p^{(m)}(x) = x^m/m!\ \exp(-x)$ for statistically independent eigenvalues. One of the representations, which is an extension of Dyson's method for m = 0, 1, is applied to the superposition of n independent sequences of levels. General asymptotic results are found for the mth-order distributions for (a) small x, arbitrary n, and (b) arbitrary x with $n \to \infty$. (auth)

26588 CLASS OF ENSEMBLES IN THE STATISTICAL THEORY OF ENERGY-LEVEL SPECTRA. Harvey S. Leff (State Univ. of Iowa, Iowa City). J. Math. Phys. (N. Y.), 5: 763-8(June 1964).

The investigation of a large class of ensembles in the statistical theory of energy-level spectra is initiated. Each member of this class is characterized by a joint probability density for N consecutive eigenvalues of the form $P_{N\beta}(\lambda_1, \cdots \lambda_N) = \Omega_{N\beta}^{-1}\{\Pi_{i=1}^{N} f(\lambda_i)\}\ \Pi_{k<l} |\lambda_k - \lambda_l|^{\beta}$, where $a \leq \lambda_i \leq b$, and β may be 1, 2, or 4. Formal calculations of the nearest-neighbor spacing distribution and the level density are made for $\beta = 2$. Results are in terms of asymptotic properties of orthogonal polynomials. It is conjectured that spacing distributions are relatively insensitive to the function $f(\lambda)$ and the interval [a,b]. When $f(\lambda) = 1$ and $b = -a = 1$, the resulting (Legendre) ensemble has the same spacing distribution as the Gaussian and Dyson ensembles. The level density is concave upward and rapidly increasing $\lambda \geq 0$, qualitatively resembling actual nuclear and atomic densities. This feature is not present in previously investigated ensembles. Certain invariant matrix ensembles introduced by Dyson, which are of the above type, have the same level density and nearest-neighbor spacing distribution as the Legendre ensemble. (auth)

26589 INVESTIGATION OF NUCLEAR REACTIONS INDUCED BY HIGH ENERGY BREMSSTRAHLUNG. Akira Masaike (Kyoto Univ.). J. Phys. Soc. Japan, 19: 427-36 (Apr. 1964).

Cross sections for photoreactions of ^{27}Al, ^{12}C, and Cu were measured by the activation method in the gamma energy range from 150 to 720 Mev. The integrated cross sections for the reactions ^{27}Al$(\gamma,\pi^+)^{27}$Mg, ^{27}Al → ^{24}Na, ^{27}Al → ^{18}F, and ^{12}C → ^{11}C in the energy region between 200 and 400 Mev were 2.2×10^{-26}, 6.2×10^{-26}, 2.4×10^{-25}, and 2.0×10^{-25} cm^2 × Mev, respectively. These values seem to be plausible from the point of view of the pion photoproduction, the nonmesonic dipole absorption of photons, and the reabsorption of the pion in the nucleus. The excitation curves for the reactions ^{27}Al$(\gamma,\pi^+)^{27}$Mg and ^{27}Al → ^{24}Na show that the $(^3/_2, ^3/_2)$ resonance state of a nucleon has an appreciable effect on these reactions. However, the resonances appear to be broadened probably due to the momentum distributions of nucleons in the nucleus. (auth)

26590 THE MEASUREMENT OF T(d,n) REACTION NEUTRON FLUX BY ACTIVATION METHOD AND SCINTILLATION METHOD. Shigetoshi Antoku and Haruma Yoshinaga (Hiroshima Univ.). Nippon Igaku Hoshasen Gakkai Zasshi, 23: 90-9(Apr. 24, 1963).

An activation method using the ^{32}S(n,p)^{32}P reaction and

a plastic scintillation device were used to measure neutron flux. The calculation of neutron flux, based on the counts recorded by the scintillation spectrometer equipped with plastic scintillator and on the amount of radioactive products, is described, and also the identification of radioactive products in neutron-irradiated S, with a comparison of the data obtained by the two methods. The neutron source used in the study was the T(d,n) reaction neutron generator. This generator supplies monoenergetic neutrons of 14.1 Mev. As the nuclear reaction cross-section of $^{32}S(n,p)^{32}P$ reaction for 14.1-Mev neutrons is large and the resultant ^{32}P has a long half life, this reaction is useful for the measurement of neutron flux. Fast neutrons were produced by bombarding a T target, adsorbed on a thin layer of Ti, with deuterons accelerated at 150 kv. The main activation product in irradiated S was identified as ^{32}P. A competing reaction was observed, and although the competing product could not be identified, it was believed to be ^{31}Si. The difference of the activity in each sample irradiated under the same conditions was less than ±10%, but in the absolute neutron flux measurement, the nuclear reaction cross-section of the $^{32}S(n,p)^{32}P$ reaction strongly affected the accuracy of the dosimetry. The activity of the samples at given distances from 5 to 11 cm from the target was attenuated according to the inverse square of distance. The counting efficiency of the scintillator for neutrons was 0.0795/cm^2 for double scattering. The ratio of scintillation dose to activation dose was 0.925 (single scattering) and 0.856 (double scattering) when 0.30 barn was used as the cross-section of the $^{32}S(n,p)$ reaction, and 1.140 (single scattering) and 1.056 (double scattering) when 0.37 barn was used. The error of dose estimation by this method was within ±25%. (BBB)

26591 BINDING ENERGIES OF LIGHT HYPERFRAGMENTS. K. Dietrich (Univ. of California, Berkeley), H. J. Mang, and R. Folk. Nucl. Phys., 50: 177-201(Jan. 1964). (UCRL-11452)

The binding energies of $_\Lambda H^3$, $_\Lambda He^4$ and $_\Lambda H^4$, and $_\Lambda He^5$ are calculated using an independent pair approximation assuming the interactions are described by spin-dependent N-N and Λ-N potentials with square-well shapes outside of hard cores. The calculated binding energies are presented as functions of the depths of the Λ-N potentials for two possible ranges of these potentials. The experimental binding energies then determine the actual potential depths. The case in which the singlet potential is stronger than the triplet potential is favored for both ranges treated. This result leads to a prediction of zero spin for $_\Lambda He^4$ and $_\Lambda H^4$ and no bound excited states for these four-particle hypernuclei. The two-particle Λ-N system also turns out to be unbound. (auth)

26592 NEGATIVE PARITY STATES IN F^{19}. M. Harvey (Chalk River Nuclear Labs., Ont.). Nucl. Phys., 52: 542-60(Apr. 1964).

The low-lying negative parity states in ^{19}F are discussed within the framework of the Elliott SU_3 shell model with a conventional, residual interaction. The lowest states with spins $J = \frac{1}{2}^-$, $\frac{5}{2}^-$ and $\frac{3}{2}^-$ at 0.110, 1.35 and 1.46 Mev, respectively, are shown to belong to a $K = \frac{1}{2}^-$ band; the $J = \frac{1}{2}^-$ and $\frac{3}{2}^-$ levels of this band are predicted at ≈3.75 Mev. A $K = \frac{3}{2}^-$ band is expected at ≈4.85 Mev with the $J = \frac{5}{2}^-$ level of the band possibly being that at 6.09 Mev. Predictions of M1 and E2 transitions are made; the agreement with the available experimental data is good. A predicted E3 transition is an order of magnitude smaller than that observed. The similarity between the SU_3 results and those arising from the rotational model and the core excitation model is discussed. (auth)

26593 EXCITED STATES IN ^{29}P BY THE REACTION $^{28}Si(p,\gamma)^{29}P$. Hiroyasu Ejiri, Haruko Ohmura, Yutaka Nakajima, Kinuko Horie, Yoshio Hashimoto, Kiichi Eto, Shinji Matsumoto, and Yozo Nogami (Tokyo Univ.). Nucl. Phys., 52: 561-77(Apr. 1964).

The excited states in ^{29}P were investigated using the reaction $^{28}Si(p,\gamma)^{29}P$ for proton energies between 1.3 and 3.2 Mev. Gamma rays from the resonances at 1.383 ± 0.003, 1.655 ± 0.005, 2.086 ± 0.006, 2.88 ± 0.02 and 3.111 ± 0.006 Mev were studied. These resonances correspond to the excited states in ^{29}P at 4.082 ± 0.01, 4.345 ± 0.01, 4.761 ± 0.01, 5.53 and 5.751 ± 0.01 Mev, respectively. Gamma rays from the 4.08 Mev state lead to the excited states at 1.38 and 1.96 Mev. The radiation widths are 0.9 ± 0.4 and 1.1 ± 0.5 Mev, respectively. The 4.35-Mev state de-excites to the ground state and the first excited state with radiation widths 1.8 ± 0.4 and 0.26 ± 0.1 ev, respectively. The 4.76-Mev state showed the gamma radiation feeding the excited state. The radiation width is 0.33 ± 0.1 ev. Capture gamma rays were not observed at 2.88 Mev resonance. Gamma transition widths from the 5.75 Mev state to the first and the second excited states are estimated to be less than 0.06 and not more than 0.08 ev, respectively. The analysis of angular distributions of the de-excitation gamma rays is consistent with the assignment of $J^\pi = \frac{1}{2}^+(\frac{5}{2}^+)$ and $\frac{3}{2}^-$ to the 4.08- and 4.35-Mev states. Proton widths Γ_p were determined to be less than 3, 56 ± 6, 18 ± 5 and 4.5 ± 1.5 kev for the states at 4.08, 4.35, 4.76 and 5.75 Mev, respectively. Properties related to the collective motion as well as the individual particle motion are found in the low-lying excited states in ^{29}P. (auth)

26594 STRUCTURE OF EXCITED STATES IN ^{29}P. Hiroyasu Ejiri (Tokyo Univ.). Nucl. Phys., 52: 578-89(Apr. 1964).

The structure of ^{29}P was studied in both the strong-coupling model and the weak-coupling model. The energy levels, spins, parities and proton and gamma emission widths were calculated using the wave functions obtained. These theoretical values are compared with the experimental results on ^{29}P. The predictions of the Nilsson model with the oblate deformation $\eta = -3$ show good overall agreement with the experiments. The vibrational model in which a proton is coupled with the core ^{28}Si is found not to be in quantitative accord with some properties of ^{29}P. (auth)

26595 THE DECAY OF ^{93}Mo. K. Hohmuth, G. Mueller, and J. Schintlmeister (Zentralinstitut für Kernforschung, Rossendorf, Ger.). Nucl. Phys., 52: 590-602(Apr. 1964). (In German)

The isomeric level of ^{93}Nb was investigated with a proportional counter. The K/(L + M) and K/L ratios of the 30-kev transition were found to be 0.18 ± 0.02 and 0.21 ± 0.02, respectively. These values nearly correspond to an M4 transition. Proportional counter measurements show that ^{93}Mo decays into ^{93m}Nb and ^{93}Nb with branching ratios of 85% and 15%, respectively. The disintegration energy to the ground state was calculated from the P_L/P_K ratio to be 173 kev. The half-life of ^{93}Mo is greater than 100 y. (auth)

26596 OPTICAL MODEL AND DISTORTED WAVE ANALYSIS OF (He^3,t) REACTIONS. J. R. Rook and P. E. Hodgson (Oxford Univ.). Nucl. Phys., 52: 603-8(Apr. 1964).

The theories previously used to analyze (p,n) reactions proceeding to the analog isobaric state of the target are applied to the measurements of Blair and Wegner on the corresponding (^{3}He,t) reactions. The strength of the isospin dependent term (t · T) in the optical potential is estimated, and the sensitivity of the calculated (^{3}He,t) cross

section to the parameters of the nuclear optical potential is investigated. Distorted wave calculations are made for the (^{3}He,t) reaction assuming several reaction mechanisms, including direct knockout and one- or two-nucleon transfer; and it is found for the cases considered that the (^{3}He,t) cross sections depend mainly on the angular momentum transfer. (auth)

26597 LEVEL DENSITIES OF MEDIUM MASS NUCLEI. A. Aspinall, G. Brown, and J. G. B. Haigh (Bradford Inst. of Tech., Yorkshire, Eng.). Nucl. Phys., 52: 630-40(Apr. 1964).

Single-particle level densities were obtained by analysis of data obtained with magnetic spectrographs and in experiments on resonance capture of slow neutrons. The values obtained from the two types of data are not consistent in magnitude or in the manner of their variation with nucleon numbers near closed shells. (D.C.W.)

26598 DYNAMIC NUCLEAR ORIENTATION FOR NUCLEI OF SPIN I = 1. Mary Duns Scotus Breitbart and W. A. Barker (Saint Louis Univ.). Nucl. Phys., 52: 641-7 (Apr. 1964).

Dynamic nuclear polarization and alignment by both the Overhauser and Jeffries-Abragam techniques are investigated analytically for nuclei of spin I = 1 interacting with paramagnetic electrons of spin S = ½ in a strong magnetic field. Various assumptions are made regarding the relative magnitude of the nuclear Zeeman interaction and the hyperfine interaction, the algebraic signs of γ_n and A and the type of relaxation. It is found in all cases treated that high percentage values of nuclear orientation may be achieved for $H_0/T \approx 4 \times 10^4$ G/deg. Both positive and negative polarization and alignment are possible. One unusual case of alignment approaching minus two, while the polarization goes to zero, is found to be the result of the filling up at low temperature of the m = 0 nuclear spin state. (auth)

26599 EVIDENCE OF NUCLEAR SHELL EFFECTS IN Ni^{58} REACTIONS INDUCED WITH 0-48 Mev ALPHA PARTICLES. Marshall Blann and George Merkel (Univ. of Rochester, N. Y.). Nucl. Phys., 52: 673-91(Apr. 1964).

Excitation functions for $^{58}Ni(\alpha,\alpha p)^{57}Co$, $^{58}Ni(\alpha,\alpha n)^{57}Ni$, $^{58}Ni(\alpha,\alpha pn)^{56}Co$, and $^{58}Ni(\alpha,\alpha 2n)^{56}Ni$ reactions were measured radiochemically for alpha energies up to 48 Mev. The decrease in the experimental $(\alpha,\alpha n)$ and $(\alpha,\alpha p)$ excitation functions above the threshold of the competing $(\alpha,\alpha pn)$ and $(\alpha,\alpha 2n)$ excitation functions is in qualitative agreement with the compound nucleus reaction model. The experimental results were compared with statistical theory calculations that assume level densities of the form $\rho(E) = (\text{const})\ E^{-2} \exp\{2(aE)^{1/2}\}$, where the nuclear excitation energy E was corrected for pairing. The value of the parameter a was set equal to the experimental value determined by Brady and Sherr. The statistical theory calculations utilized optical model inverse cross sections calculated with independently determined optical model parameters when these parameters were available. Cross sections were calculated for all permutations of n, p, d, t, ^{3}He and α emission for two successive evaporations, followed by calculation of a third evaporation of a neutron, proton, or alpha particle where it was energetically possible. The influence of competition between gamma de-excitation and low energy proton emission on excitation function cross sections was estimated. The nuclear level density expression used in these statistical theory calculations was not modified to consider nuclear shell structure effects. The closer the residual nucleus is to the doubly closed shell nucleus ^{56}Ni, the greater the divergence between the calculated and the experimental cross sections. This divergence between calculated and experimental excitation functions is discussed in terms of both the Bloch and the Rosenzweig treatments of the influence of nuclear shell structure on nuclear level densities. (auth)

26600 ELASTIC AND INELASTIC SCATTERING OF 14.1 Mev NEUTRONS FROM C, Mg, Si, AND S. R. L. Clarke and W. G. Cross (Chalk River Nuclear Labs., Ont.). Nucl. Phys., 53: 177-203(Apr. 1964).

The differential cross sections for the elastic scattering of 14.1-Mev neutrons and for inelastic scattering to the first-excited state measured for ^{12}C, ^{24}Mg, ^{28}Si, and ^{32}S. Elastic and inelastic neutrons were separated by their flight times. Scattering to higher states was observed, but a differential cross section was obtained only for the 9.6-Mev state of ^{12}C. Good optical model fits to the elastic scattering results for ^{24}Mg, ^{28}Si, and ^{32}S were found. The same optical model parameters were then employed in a distorted wave Born approximation calculation, which gave a good fit to the shape of the angular distributions for scattering to the first-excited states of these nuclei. The fits to the magnitude of this scattering yielded values of the mean-square quadrupole distortions of 0.62, 0.43, and 0.32 for ^{24}Mg, ^{28}Si, and ^{32}S, respectively, in good agreement with values derived from electromagnetic measurements on these states. For ^{12}C, both the elastic and inelastic scattering results show a definite disagreement between experiment and theory. 82 references. (auth)

26601 NEUTRONS FROM THE PROTON BOMBARDMENT OF Li^6, Li^7, Be^9, B^{11}, AND O^{18}. J. K. Bair, C. M. Jones, and H. B. Willard (Oak Ridge National Lab., Tenn.). Nucl. Phys., 53: 209-18(Apr. 1964).

The total neutron yield from proton bombardment was measured for ^{6}Li from threshold to 14 Mev; for ^{7}Li, ^{9}Be, and ^{11}B from 4 to 14 Mev; and for ^{18}O from 3.5 to 10 Mev. The $^6Li(p,n)^6Be$ reaction Q value measured in this experiment is -5.05 ± 0.05 Mev, giving a ^{6}Be mass excess of 18.36 ± 0.05 Mev. The neutron yield from ^{7}Li at higher energies can not be explained on the basis of the (p,n) reaction alone and is ascribed in part to multi-particle breakup. An anomaly in the neutron yield curve for $^9Be(p,n)$ is ascribed to a threshold for production of neutrons by a state in ^{9}B at 4.04 Mev. The $^{11}B(p,n)^{11}C$ reaction results confirm previous level structure in ^{12}C and a new "level" at $E_p = 11.85$ Mev (energy of excitation in ^{12}C of 26.81 Mev.) The neutron yield for $^{18}O(p,n)$ shows 21 resonant peaks (energy of excitation from 11.4 to 16.8 Mev). (auth)

26602 RADIOCHEMICAL INVESTIGATION OF ASTATINE PRODUCED IN SECONDARY REACTIONS FOLLOWING BOMBARDMENTS OF BISMUTH AND LEAD WITH HIGH-ENERGY PARTICLES. V. N. Mekhedov (Joint Inst. for Nuclear Research, Dubna, USSR). Nucl. Phys., 53: 225-34(Apr. 1964).

Experimental results on the production rate of various At isotopes (Z = 85) in bombarding Bi (Z = 83) and Pb (Z = 82) by high-energy protons, deuterons, and α-particles are discussed. Astatine isotopes are produced due to the secondary reactions of disintegration product capture. The analysis of data on the investigation of secondary reactions shows the existence of specific multiparticle nucleon interactions at high energies. (auth)

26603 DECAY OF THE $f_{\frac{5}{2}}$ LEVEL IN ^{207}Pb. G. Chilosi, R. A. Ricci, J. Touchard, and A. H. Wapstra (Istituto di Fisica Nucleare, Naples). Nucl. Phys., 53: 235-40 (Apr. 1964).

The ratio of the intensities of the 1440-kev $f_{\frac{5}{2}}$-$p_{\frac{3}{2}}$ and 1771-kev $f_{\frac{5}{2}}$-$f_{\frac{5}{2}}$ transitions in ^{207}Pb was determined to be 0.023 ± 0.002. It was concluded that the M1 transition in

the latter presumably very pure spin flip transition is probably hindered by a factor of four. (auth)

26604 INTERACTIONS OF 31 Mev PROTONS WITH He^4. S. M. Bunch, H. H. Forster, and C. C. Kim (Univ. of Southern California, Los Angeles). Nucl. Phys., 53: 241-51(Apr. 1964).

Angular distributions were measured at center-of-mass angles ranging from ≈6 to 160° for proton elastic scattering and from ≈15 to 100° for the deuteron pickup reaction $^4He(p,d)^3He$. The differential elastic scattering cross section was fitted by an optical model analysis which included both surface and volume absorption. The deuteron angular distributions were fitted by calculations based on the direct interaction theory of Butler and the distorted wave Born approximation with diffuse-well optical potentials as proposed by Smith and Ivash. (auth)

26605 STATES IN N^{14} NEAR THE PROTON THRESHOLD. L. G. Earwaker and D. F. Hebbard (Australian National Univ., Canberra). Nucl. Phys., 53: 252-63(Apr. 1964).

Using a nitrogen gas target and solid state detectors, the reaction $^{14}N(p,p')$ was investigated at closely spaced proton energies from 9.15 to 10.45 Mev at angles of 60, 90, and 120°. An ^{14}N state previously reported at 7.60-Mev excitation, was not observed. This is a direct contradiction, as the present work covers the same energy and angle as the earlier work. However, an alternative interpretation of the earlier work is advanced. The ground state and 2.31, 3.95, 4.91, 5.10, 5.69, 5.83, 6.21, 6.44, 7.03, 7.97, and 8.06-Mev states were observed. No other ^{14}N states were observed below 8.06-Mev excitation, and an upper limit to the cross section for any unobserved states near the $^{13}C(p,\gamma)$ threshold is 2μb/sr. (auth)

26606 ENERGY SPECTRUM OF ALPHA PARTICLES FROM THE $La^{139}(n,\alpha)Cs^{136}$ REACTION WITH 14.1 Mev NEUTRONS. M. Jaskola, W. Osakiewicz, J. Turkiewicz, and Z. Wilhelmi (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw and Univ. of Warsaw). Nucl. Phys., 53: 270-2(Apr. 1964).

The energy spectrum of alpha particles from the $^{139}La(n,\alpha)^{136}Cs$ reaction at 14.1 Mev was measured using the semiconductor detector. The ratio between the alpha emission in the forward and the backward directions was estimated. (auth)

26607 NUCLEAR MATRIX ELEMENTS OF THE FIRST-FORBIDDEN BETA TRANSITIONS OF THE TYPE $3^-(\beta)2^+$. I. ANALYSIS OF THE EXPERIMENTAL DATA IN THE BETA DECAY OF Sb^{124}, Eu^{152}, Eu^{154}, Ga^{72}, AND La^{140}. P. Lipnik and J. W. Sunier (Swiss Federal Inst. of Tech., Zurich). Nucl. Phys., 53: 305-16(Apr. 1964).

The nuclear matrix elements of the outer beta transitions in the decay of ^{124}Sb, ^{152}Eu, ^{154}Eu, ^{72}Ga, and ^{140}La are investigated in a χ^2-analysis involving all presently known experimental data. The relation between the matrix elements $\int i\alpha$ and $\int r$, predicted by the theory of conserved vector current in weak interactions, is assumed to be valid and reduces the number of independent nuclear parameters to two. A unique set of parameters is given in the cases of ^{152}Eu and ^{124}Sb. A probable set is suggested for ^{154}Eu. A cancellation of the matrix elements of tensor order 1 is observed, and relations between the nuclear parameters are given for ^{140}La. Propositions for theoretical computations are made. (auth)

26608 SOME RECENT RESULTS CONCERNING FISSION AND FRAGMENTATION AT HIGH ENERGIES. H. G. de Carvalho, G. Cortini, M. Muchnik, R. Rinzivillo, and E. Sassi (Università, Naples and Istituto Nazionale di Fisica Nucleare, Naples). Nucl. Phys., 53: 345-9(Apr. 1964).

An examination of results on the disintegration of some heavy nuclei induced by high-energy protons or photons, leads to the conclusions that there exists some essential physical difference between the fission at high energies of heavy nuclei and of medium nuclei, and that it is reasonable to consider the fission of relatively light nuclei to be physically related more to the fragmentation than to the ordinary fission phenomenon. (auth)

26609 EXCITATION OF LEVELS OF O^{16} BY ELECTRON SCATTERING. G. R. Bishop, C. Betourne, and D. B. Isabelle (Ecole Normale Superieure, Orsay, France). Nucl. Phys., 53: 366-74(Apr. 1964).

Differential cross sections for inelastic scattering of electrons by oxygen nuclei, with excitation of a number of known levels, were measured. Spin and parity assignments to these levels are made after examination of the dependence of the inelastic form factors on scattering angle and momentum transfer. For some of the levels for which wave functions were predicted there is good agreement between calculated and experimental values of both longitudinal and transverse form factors. (auth)

26610 THE COULOMB EXCITATION OF Se^{76} AND Se^{78} USING OXYGEN IONS. W. Bygrave (Oxford Univ.), D. Eccleshall, and M. J. L. Yates. Nucl. Phys., 53: 385-96 (Apr. 1964).

The nuclei ^{76}Se and ^{78}Se were Coulomb excited with 37 Mev oxygen ions. In both isotopes $2'^+$ and 4^+ levels were observed at approximately twice the energy of the first-excited state. The spins of these levels were determined in ^{16}O-γ angular correlation measurements, and the transition strengths were interpreted from the γ yields. There is evidence that both nuclei may have collective 0^+ levels in this energy region. Effects arising from the static quadrupole moments of excited states are discussed. (auth)

26611 CALCULATION OF NEUTRON CAPTURE γ-RAY SPECTRA INCLUDING GIANT RESONANCE EFFECTS. N. Starfelt (Research Inst. of National Defence, Stockholm). Nucl. Phys., 53: 397-408(Apr. 1964).

Neutron capture γ spectra were calculated with an electric-dipole γ strength function derived through extrapolation of the E1 giant resonance to lower energies. To obtain agreement with experiment for such elements as Cs and Au it was necessary to assume a second peak in the γ strength function at an energy of about 5.5 Mev. The position of this peak and the absolute value as well as the dependence on mass number of its strength indicate that it may be the M1 giant resonance predicted by Mottelson. (auth)

26612 COLLECTIVE EXCITATIONS IN NUCLEAR MATTER. A. G. Sitenko and I. V. Simenog (Inst. of Physics, Ukrainian Academy of Sciences, Kiev). Nucl. Phys., 53: 409-16(Apr. 1964).

Collective excitations in nuclear matter are considered on the basis of the Fermi-liquid model. Spectral distributions of correlation functions are found for density fluctuations and for the spin and isobaric spin densities. The existence of two branches of collective excitations in nuclear matter—density and isospin sound—is shown. The scattering of nucleons in nuclear substance accompanied by the excitation of collective vibrations is considered in the impulse approximation. (auth)

26613 THE LOW-LYING LEVELS OF Al^{27}. II. THE 3 Mev DOUBLET LEVELS. B. T. Lawergren (Australian

National Univ., Canberra). Nucl. Phys., 53: 417-28(Apr. 1964).

The decay of the 2.976 and 3.000 Mev levels in ^{27}Al was observed. The only significant branching, apart from ground state transitions, is the (20 ± 10)% cascade 3.000 → 2.212 → 0. The E2/M1 amplitude mixing ratio of the 3.000 → 2.212 transition is −0.03 ± 0.03. The presently known properties of the ^{27}Al levels are discussed in terms of the two extreme coupled collective models. (auth)

26614 THE ^{11}B(p,p′) REACTION AT 150 Mev AND THE UNIFIED MODEL OF ^{11}B. D. Newton, A. B. Clegg, G. L. Salmon, and D. J. Rowe (Oxford Univ.). Nucl. Phys., 53: 433-48(Apr. 1964).

Measurements are presented of the ^{11}B(p,p′) reaction due to 150 Mev protons. Cross sections were determined for exciting individual states of ^{11}B up to an excitation of 9 Mev. Gamma angular correlation measurements were made, verifying the understanding of the mechanism of the inelastic scattering reaction. In particular it is shown that the strongly excited state at 6.8 Mev is the $J = \frac{7}{2}^-$ state at 6.76 Mev and not the $J = \frac{3}{2}^+$ state at 6.81 Mev, and a multipole mixing ratio in the decay of the 4.46 Mev state is found, in agreement with other measurements. Results are consistent with the unified model of ^{11}B discussed previously. The related information obtained from previous polarization measurements, which show that the strong inelastic scatterings involve no flip of either spin or isobaric spin, is also discussed. (auth)

26615 ALPHA DECAY PROPERTIES OF SOME TERBIUM AND DYSPROSIUM ISOTOPES NEAR THE 82-NEUTRON CLOSED SHELL. Ronald D. Macfarlane and David W. Seegmiller (Univ. of California, Berkeley). Nucl. Phys., 53: 449-56(Apr. 1964).

Half lives and alpha-particle energies of ^{149m}Tb, ^{151}Tb, ^{150}Dy, ^{151}Dy, ^{152}Dy, and ^{153}Dy were measured with greater precision than previously reported. Alpha branching ratios were also obtained, using direct counting techniques. (auth)

26616 PRECISION DETERMINATION OF THE THRESHOLD ENERGY OF THE T(p,n)^{3}He REACTION AND THE NEUTRON-PROTON MASS DIFFERENCE. R. C. Salgo, H. H. Staub, H. Winkler, and F. Zamboni (Universität of Zurich). Nucl. Phys., 53: 457-64(Apr. 1964).

An absolute precision determination of the threshold energy for the T(p,n)^{3}He reaction performed, using an improved type of target consisting of isotopically pure tritiated ice. The result $E_{Th} = 1019.00 \pm 0.10$ kev is somewhat lower but more accurate than previous values. The Q value obtained is $Q = -763.77 \pm 0.08$ kev. Published values of the maximum β-energy of tritium are reviewed. The neutron-proton mass difference is given as 782.3 ± 0.1 kev. (auth)

26617 THE EXCITED STATE AT 25 Mev IN Be^8. P. Paul and K. P. Lieb (Universität, Freiburg i. B.). Nucl. Phys., 53: 465-76(Apr. 1964).

The 25 Mev state in ^{8}Be was investigated by deuteron capture on ^{6}Li. Excitation curves for several angles were taken for the reactions ^{6}Li(d,α), ^{6}Li(d,d), ^{6}Li(d,p_0), and ^{6}Li(d,p_1). The data were analyzed in terms of a two level interference of the resonance at $E_d = 3.7$ Mev with the lower one at $E_d = 0.8$ Mev. The spin-parity assignment $J^\pi = 2^+$ seems to be slightly favored, but $J^\pi = 0^+$ is also possible. From the σ(d,α) resonance curve, a total width of the 25 Mev level of Γ < 1.4 Mev in the center-of-mass is deduced. The d-wave capture seems to be favored for the deuterons. The data presented here and the cross section for ^{7}Li(p,α) measured elsewhere are used to estimate within a factor of two partial widths under the assignment $J^\pi = 2^+$: $\Gamma_d \approx 0.500$ Mev, $\Gamma_\alpha \approx 0.800$ Mev, $\Gamma_p < 0.130$ Mev or $\theta_d^2 \approx 0.20$ (d wave), $\theta_\alpha^2 \approx 0.025$, $\theta_p^2 < 0.005$ (p wave), each in terms of its Wigner limit (a = 4.4 fm). From these estimates it seems not unlikely to assume a (^{6}Li + d) cluster configuration for the 25 Mev state. (auth)

26618 THE CHARGE DEPENDENCE OF NUCLEAR FORCES AND THE ENERGY SEPARATION OF THE ISOBARIC TRIPLET A = 14. L. Lovitch (Istituto Nazionale di Fisica Nucleare, Pisa, Italy). Nucl. Phys., 53: 477-83 (Apr. 1964).

An analysis of the energy differences of the isobaric triplet of mass number 14 is presented using the harmonic oscillator shell model for the nuclear wave functions. These differences are attributed to the Coulomb and another charge dependent potential presented previously, and they are calculated in first order perturbation theory. Assuming that the spring constant of the wave function is the same for each member of the triplet, its value is calculated from the experimental data on the outer pair. Good agreement of the position of the third member with the experimental situation is found when the intermediate coupling wave function of Visscher and Ferrell is adopted for the calculation. (auth)

26619 THE ENERGY LEVELS OF Cr^{50}. P. J. Twin and J. C. Willmott (Univ. of Liverpool). Nucl. Phys., 53: 484-96(Apr. 1964).

Twenty-two excited states of ^{50}Cr were identified in inelastic proton scattering experiments. The modes of decay and branching ratios for many of these states were experimentally determined by observing the gamma rays in coincidence with individual proton groups. (auth)

26620 THE MEASUREMENT OF THE L SHELL PARTICLE PARAMETERS IN THE 42 kev E3 TRANSITION OF Ir^{191}. B. I. Deutch and P. Hornshoej (Univ. of Aarhus, Denmark). Nucl. Phys., 53: 497-507(Apr. 1964).

The 42 kev-129 kev cascade in ^{191}Ir was studied with a single-gap electron-gamma angular correlation spectrometer. The ratio of the K conversion electron to L conversion electron intensity of the 129 kev transition is K/L = 4.42 while the L subshell ratio is $(L_I + L_{II})/L_{III} = 7.55 \pm 0.35$, resulting in the magnitude of the mixing amplitude of the 129 kev transition being $|\delta|_{129} = 0.40$ or $|\delta|_{129} = 0.395 \pm 0.015$, respectively. In the 42 kev transition, the L subshell ratio is $(L_I + L_{II})/L_{III} = 0.97 \pm 0.03$, indicating the transition to be a pure E3. Directional correlations with the 42 kev L shell electrons and the 129 kev gamma ray were measured and are of the form $W(\theta) = 1 + A_2P_2(\cos\theta)$. The results with metallic Os sources on different metallic backings are similar. The average values are $A_2(42\ L_{II}\ e^- - 129\ \gamma) = -0.305 \pm 0.012$ and $A_2(42\ L_{III}\ e^- - 129\ \gamma) = -0.313 \pm 0.013$, for the L_{II} and L_{III} e^--γ correlations, respectively. From these correlations and the theoretical form of the particle parameters, it is shown that δ_{129} is negative. From the e^--γ correlations and the L subshell ratios, the E3 particle parameters that enter the A_2 term for the L_{II} and L_{III} electrons are $b_2(42\ L_{II}) = 0.965 \pm 0.040$ and $b_2(42\ L_{III}) = 0.991 \pm 0.043$. (auth)

26621 THE INFINITE DILUTE RESONANCE INTEGRAL OF THORIUM. M. Brose (Kernforschungszentrum, Karlsruhe, Ger.). Nucl. Sci. Eng., 19: 244-5(June 1964).

An activation method was used to determine the infinite dilute resonance integral of thorium. (C.E.S.)

26622 THE BINDING ENERGY DIFFERENCE BETWEEN THE HYPERNUCLIDES ^{4}He$_\Lambda$ AND ^{4}H$_\Lambda$. M. Raymund (Univ. of Chicago). Nuovo Cimento (10), 32: 555-87 (May 1, 1964).

Experimental and theoretical studies indicate a departure

from charge symmetry for the mirror hypernuclei $^4He_\Lambda$ and $^4He_\Lambda$ amounting to a few tenths of a Mev in the binding energies. A nuclear emulsion experiment utilizing 45 newly measured meson (π^-) decays of $^4He_\Lambda$ and $^4H_\Lambda$ is reported to give $\Delta B_\Lambda = B_\Lambda(^4He_\Lambda) - B_\Lambda(^4H_\Lambda) = (0.55 \pm 0.26)$ Mev. By adding events from the literature to this sample, a total of 214 meson (π^-) decays of these hypernuclei was obtained. This number proved sufficient to resolve the difficulties previously encountered in an experimental evaluation of ΔB_Λ. Contamination by other hypernuclides (probably $^5He_\Lambda$) was eliminated from the $^4He_\Lambda$ sample by a strict recoil-range requirement ($R_{rec} \geq 10$ μm), while, on the other hand, no contaminants were found among the $^4H_\Lambda$ decays. The binding energy discrepancy between the πr and πpr decays of $^4H_\Lambda$ was found to be due to pion range measurement losses which are important mainly for the πr events ($R_\pi \sim 4$ cm). The final value of ΔB_Λ for the latter sample is (0.30 ± 0.14) Mev. Because a negative term in the theoretical calculation of ΔB_Λ is expected from a Coulomb energy increase in the ^3He core of $^4He_\Lambda$, this positive experimental result is a strong indication of charge-symmetry violation in the hyperon (Λ)-nucleus interaction compatible with estimates of the virtual electromagnetic effects in ($\Lambda \rightarrow \Lambda + \pi^0$). (auth)

26623 A BUBBLE CHAMBER STUDY OF THE TRAPPING OF Λ-HYPERONS IN NUCLEAR MATTER. W. L. Knight (Univ. of London), F. R. Stannard, F. Oppenheimer, B. Rickey, and R. Wilson. Nuovo Cimento (10), 32: 598-608(May 1, 1964).

A study was made of 2191 interactions of mesons (K^-) at rest in a mixture of Cr_3Br and propane. From the estimated numbers of hyperons emitted, it was found that $(21.3 \pm 1.8)\%$ of the stars gave rise to hyperons (Λ) that remain trapped within nuclear matter. This result confirms previous work requiring the probability of trapping to be considerably greater than that inferred solely from the frequency of the production of hyperfragments observable in nuclear emulsion. (auth)

26624 EXCITED STATES IN MASS-TWELVE NUCLEI. G. F. Nash (Wadham Coll., Oxford). Nuovo Cimento (10), 32: 727-44(May 1, 1964).

A shell-model calculation in LS-coupling of the unexcited, singly-, and twice-excited states of mass-twelve nuclei was carried out using the SU(3)-coupling scheme. The binding energies of groups of states were evaluated using a two-body central force mixture diagonal in the various relative states of motion of the nucleons. The electric dipole and electric quadrupole states were examined, and the strength from the ground state to some of these states calculated. Encouraging agreement was found with all the established states in ^{12}C, and further states were predicted. (auth)

26625 NUCLEAR MAGNETIC RESONANCE OF La^{139} AND Al^{27} AND ELECTRON PARAMAGNETIC RESONANCE OF Fe^{3+} IN LANTHANUM ALUMINATE. K. A. Mueller (IBM Research Lab., Zurich), E. Brun, B. Derighetti, J. E. Drumheller, and F. Waldner. Phys. Letters, 9: 223-6 (Apr. 15, 1964).

The NMR spectra of La-139 and Al-27 and the EPR spectra of Fe^{3+} were investigated in order to compare further field parameters with the rhombohedral distortion angle as a function of temperature. Electric nuclear quadrupole effects were found for La and Al; the quadrupole coupling constant is obtained using the usual hamiltonian. Spin-hamiltonian parameters were determined from the spectra of Fe^{3+}. (M.J.T.)

26626 A SIMPLE ANALYTICAL TREATMENT OF DWBA, STRIPPING MATRIX ELEMENT WITH FINITE RANGE INTERACTION. Gy. Bencze and J. Zimanyi (Central Research Inst. for Physics, Budapest). Phys. Letters, 9: 246-8(Apr. 15, 1964).

The problem that the finite range calculations lead to a sixfold non-separable integral can be solved in a simple way by the use of the local WKB approximation. The calculations are restricted to (d,p) reactions. The stripping integral is calculated for both Gauss and Hulthén type functions. Thence the matrix element can be calculated as in the usual zero-range case. (M.J.T.)

26627 ON THE ANGULAR ANISOTROPY OF FISSION FRAGMENTS. Yu. T. Grin (Kurchatov Inst. of Atomic Energy, Moscow). Phys. Letters, 9: 248-9(Apr. 15, 1964).

Formulas for moments of inertia and excitation energy of deformed nuclei were obtained earlier. It is found that temperature T times moment of inertia $I_{||}$ along the symmetry axis increases linearly with excitation energy E^*, at $E^* \geq 3$ Mev, when a statistical description of the angular anisotropy becomes possible. The value characterizing the pair correlation at $T = 0$ is approximated on the fission barrier. (M.J.T.)

26628 WHY IS THERE DISCREPANCY OF INTENSITY RATIOS OF ELECTROMAGNETIC TRANSITIONS WITH ALAGA'S RULES? Yu. T. Grin and I. M. Pavlichenkow (Kurchatov Inst. of Atomic Energy, Moscow). Phys. Letters, 9: 249-52(Apr. 15, 1964).

In single-particle transitions forbidden by asymptotic quantum numbers, discrepancies with Alaga's rules are rather large. If the discrepancies are due to the interaction between rotation and intrinsic motion, Coriolis forces in the first-order perturbation theory, it can be shown that the probability ratios of the transitions between levels of two rotational bands depend on two or one parameters. Zero-approximation calculations of ratios of reduced transitions are compared with experimental data. The obtained agreement indicates that the discrepancy with Alaga's rules is indeed connected with the interaction of rotation and intrinsic motion. (M.J.T.)

26629 ON THE INFLUENCE OF THE DEFORMATION OF AN EXCITED NUCLEUS ON THE EVAPORATION OF CHARGED PARTICLES. R. Da Silveira (Faculte des Sciences, Paris). Phys. Letters, 9: 252-3(Apr. 15, 1964). (In French)

The hypothesis of a very low Coulomb barrier and high nuclear radius for emission from bombarded nuclei failed to predict correctly the ratio Γ_α/Γ_n. The emission probability for a charged particle leaving the nucleus and the ratio Γ_α/Γ_n are derived, using a deformed-cylindrical-symmetry nuclear model. Calculations and experiment are compared for bismuth bombarded by protons at 155 Mev. Spectra do not correspond for the spherical model. For the deformed nucleus, the energy distribution is correct but the effective cross section is still too high. (M.J.T.)

26630 INTERNAL CONVERSION IN Tl^{203}. R. J. Lombard (Faculté des Sciences, Orsay, France). Phys. Letters, 9: 254-5(Apr. 15, 1964).

For magnetic dipole transitions, the nuclear structure effects are proportional to the ratio of the conversion matrix element to the gamma matrix element. To reproduce the experimentally derived value of this ratio, the $^3/_2+$ state wave function is written as the superposition of a core excitation and a shell-model state. These conclusions may be extended to all odd Tl and Au isotopes. (M.J.T.)

26631 DETERMINATION OF NUCLEAR MATRIX ELEMENTS IN THE DECAY OF Sb^{124} INCLUDING FINITE

NUCLEAR SIZE EFFECTS. H. J. Fischbeck and W. M. Greenberg (Univ. of Michigan, Ann Arbor). Phys. Letters, 9: 255-8(Apr. 15, 1964).

A determination of the nuclear matrix elements in the decay of ^{124}Sb is attempted, using theoretical expressions of first forbidden beta decay. Finite nuclear size effects are readily included, since electron radial wave functions appear explicitly. The transition considered is the first forbidden nonunique beta decay of the 3^- ground state of ^{124}Sb to the 603-kev first excited 2^+ state in ^{124}Te, followed by an E2 gamma ray to the 0^+ ground state in ^{124}Te. (M.J.T.)

26632 POSSIBLE FOUR-QUASIPARTICLE EXCITED STATE OF Er^{166}. Z. Preibisz and J. Żylicz (Inst. of Nuclear Research, Swierk, Poland). Phys. Letters, 9: 258-60(Apr. 15, 1964).

Results of measurements investigating the physical nature of ^{166}Er high energy levels are summarized and discussed. Multipolarity, parity, spin, and log ft values for the 2137- and 2165-kev excited levels are considered. (M.J.T.)

26633 ENERGY DISTRIBUTION AND EFFECTIVE CROSS SECTION OF PHOTOPROTONS FROM N^{14}. R. Kosiek, K. Maier, and K. Schluepmann (Universität, Heidelberg). Phys. Letters, 9: 260-3(Apr. 15, 1964). (In German)

Results of measurements of proton energy spectra from the reaction $^{14}N(\gamma,p)^{13}C$ are given for six gamma energies from 15.5 to 30.5 Mev. The effective cross section for ground-state transitions was obtained. (M.J.T.)

26634 ON THE POSSIBILITY OF SEPARATION OF REACTION MECHANISMS BY ANALYSIS OF ANGULAR CORRELATIONS OF EXCITATION FUNCTIONS. Y. Cassagnou, I. Iori, C. Levi, M. Mermaz, and L. Papineau (Centre d'Etudes Nucleaires, Saclay, France). Phys. Letters, 9: 263-6(Apr. 15, 1964). (In French)

It is seen that a complete assembly of angular correlations of excitation functions for effective differential cross sections makes obvious the contribution of direct interactions, and that information on the relative importance of the two reaction mechanisms as a function of the emission angle can be obtained. This analysis was applied to 15 differential excitation functions for each of the five first alpha groups of the reaction $^{27}Al(d,\alpha)^{25}Mg$ at 4.50 to 5.62 Mev. (M.J.T.)

26635 SPIN AND PARITY OF THE 3.13 Mev LEVEL IN P^{31}. H. A. Van Rinsvelt and P. M. Endt (Rijksuniversiteit, Utrecht). Phys. Letters, 9: 266-8(Apr. 15, 1964).

The 498-kev $J^\pi = {}^-3/2^+$ resonance in the reaction $^{30}Si(p,\gamma)^{31}P$ was used to measure the direction-polarization correlation of the (r) → (3) transition in ^{31}P. It is concluded that the spin and parity of level (3) are $J^\pi = 1/2^+$, not $3/2^+$. The mixing ratio, gamma polarization, and resonance parity are also derived. (M.J.T.)

26636 THE EMISSION OF Li^6 FRAGMENTS IN THE INTERACTIONS OF 1.5 Gev/c K^- MESONS WITH NUCLEI IN NUCLEAR EMULSION. D. M. Harmsen (Institut für Experimentalphysik, Hamburg), G. Baumann, H. Braun, and P. Cuer. Phys. Letters, 9: 274-7(Apr. 15, 1964).

A stack of nuclear emulsions was exposed to a separated beam of 1.5 Bev/c K^- mesons. The hammertrack range distribution, the heavy prong number distribution of the stars emitting hammertracks, and the hammertrack production rate, energy distribution, emission probability, and angular distributions are presented. (M.J.T.)

26637 ANALYSIS OF γ-γ ANGULAR CORRELATION MEASUREMENTS IN ALIGNED NUCLEI. S. L. Andersen, K. Gjoetterud, and F. Ingebretsen (Universitet, Oslo). Phys. Norvegica, 1: 187-91(1963).

A method for analyzing triple angular correlation data is described. An ensemble of aligned nuclei in the same state of sharp angular momentum is studied by observation of the angular correlation of the two gamma rays emitted in cascade. The population parameters describing the distribution of the nuclei in the different magnetic substates are determined by a Legendre polynomial fit to the observed intensity functions. The isotropic part of the intensity function is normalized to unity. The constraint that the sum of the population numbers equals one is properly accounted for by a Lagrange multiplier. Errors are estimated for the parameters. (auth)

26638 NUCLEON-NUCLEON POTENTIAL IN SIMILAR CONFIGURATIONS. Yeshwant R. Waghmare (Univ. of California, San Diego, La Jolla). Phys. Rev., 134: B1185-90(June 22, 1964).

Calculations were made on pair nuclei in order to obtain an effective interaction for the same shell of each pair. For the pair nuclei ^{18}O and ^{92}Zr s and d shells are considered, and for the pair nuclei ^{10}Be and ^{58}Ni the p shell is considered. It is shown that it is impossible to derive a unique effective interaction for the s and d shells due to insufficient information on the low-lying levels of ^{92}Zr. However, a Gaussian potential with range $r_0 = 1.47$ F and a nuclear force strength $v_0 = -51$ Mev gives information concerning the effective interaction for the pair nuclei ^{10}Be and ^{58}Ni. (auth)

26639 VELOCITY-DEPENDENT POTENTIALS AND THE SHELL MODEL OF OXYGEN-18. Bruce H. J. McKellar (Univ. of Sydney). Phys. Rev., 134: B1190-5 (June 22, 1964).

An expansion of the shell-model matrix elements of the velocity-dependent potential $m^{-1}[p^2V(r) + V(r)p^2]$ in the Talmi integrals of V is derived and applied to calculate the energy levels of ^{18}O using the nucleon-nucleon potential of Green. It is found that the correct ordering of the levels is obtained but the potential must be altered slightly to obtain agreement comparable with that given by Dawson, Talmi, and Walecka using the Brueckner-Gammel-Thaler potential. (auth)

26640 THEORETICAL CALCULATIONS OF PROPERTIES OF RARE-EARTH ALPHA EMITTERS. R. D. Macfarlane (McMaster Univ., Hamilton, Canada), J. O. Rasmussen, and M. Rho. Phys. Rev., 134: B1196-1200 (June 22, 1964).

New nuclear-structure calculations using a Gaussian residual force in a BCS treatment for the proton system of the 82-neutron nuclei are presented. Comparisons of theoretical binding energies with experimental odd-even mass differences and trends of alpha-decay energies are made. The best agreement with experimental energies is obtained when a force strength 10% stronger than that deduced from low-energy p-p scattering is used. The wave functions are used for theoretical alpha-decay-rate calculations, and some insight into the decrease of reduced width near the subshell Z = 64 is obtained. (auth)

26641 ELECTRIC QUADRUPOLE TRANSITIONS NEAR A = 16: THE LIFETIMES OF THE FIRST EXCITED STATES OF O^{17} AND F^{17}. J. A. Becker (Brookhaven National Lab., Upton, N. Y.) and D. H. Wilkinson. Phys. Rev., 134: B1200-4(June 22, 1964). (BNL-7711)

As the beginning of a program to study E2 lifetimes in

the neighborhood of A = 16, the mean lifetimes of the first excited states of ^{17}O and ^{17}F were measured and found to be $(2.587 \pm 0.042) \times 10^{-10}$ and $(4.068 \pm 0.087) \times 10^{-10}$ sec, respectively. (auth)

26642 INTERNAL CONVERSION IN Sn^{119}. N. Benzcer-Koller (Rutgers Univ., New Brunswick, N. J.). Phys. Rev., 134: B1205-10(June 22, 1964).

The total internal conversion coefficient of the ground-state 23.8-kev transition in ^{119}Sn and the ratio $[K/(L + M + \cdots)]_{M4}$ of internal conversion coefficients of the preceding 65.3-kev M4 transition were determined by measuring the coincidence rate between the K x rays following internal conversion of the 65.3-kev transition and the 23.8-kev gamma rays. The following results were obtained: $\alpha = 5.2 \pm 0.3$ and $[K/(L + M + \cdots)]_{M4} = 0.42 \pm 0.02$. (auth)

26643 (p,pd) REACTION. Y. Sakamoto (National Research Council, Ottawa). Phys. Rev., 134: B1211-18 (June 22, 1964).

The (p,pd) reaction with coincidence between the outgoing proton and deuteron is investigated in terms of the momentum distribution function of the two-nucleon system to be knocked out as the deuteron and the probability of finding the deuteron within the nucleus. An interaction length is defined in terms of the probability of finding the deuteron. The $^{6}Li(p,pd)^{4}He$ and $^{7}Li(p,pd)^{5}He$ reactions are considered by using single-particle harmonic-oscillator wave functions for the nucleons in the nucleus. (auth)

26644 TRITIUM PRODUCED DURING SPONTANEOUS FISSION OF CALIFORNIUM-252. Donald L. Horrocks (Argonne National Lab., Ill.). Phys. Rev., 134: B1219 (June 22, 1964).

The tritium produced during the spontaneous fission of californium-252 was collected and measured in a liquid scintillator system. One tritium atom was observed for every 4520 ± 107 fission events. (auth)

26645 ELASTIC SCATTERING OF ALPHA PARTICLES BY O^{18}. D. Powers, J. K. Bair, J. L. C. Ford, Jr., and H. B. Willard (Oak Ridge National Lab., Tenn.). Phys. Rev., 134: B1237-42(June 22, 1964).

The differential elastic scattering cross section of alpha particles by ^{18}O was measured for alpha-particle energies between 2.4 and 3.5 Mev and for $\theta_{c.m.} = 90.0$, 125.3, 140.7, 152.3, and 164.4° in order to determine the level parameters of excited states in ^{22}Ne. The resonances were analyzed using the single-level and two-level approximation to determine reduced widths and resonance energies of the levels. Scattering anomalies were observed at bombarding alpha-particle energies of 2.48, 2.56, 2.72, 2.90, 3.17, and 3.33 Mev which correspond to excited states of ^{22}Ne with the energies, angular momenta, and parities 11.70 Mev, $J^{\pi} = 2^{+}$; 11.76 Mev, $J^{\pi} = 1^{-}$; 11.89 Mev, $J^{\pi} = 1^{-}$; 12.04 Mev, $J^{\pi} = 0^{+}$; 12.26 Mev, $J^{\pi} = 0^{+}$; 12.39 Mev, $J^{\pi} = 2^{+}$. For bombarding alpha-particle energies in the vicinity of 3.5 Mev, it was found necessary to include the effects of two levels above 3.5 Mev to fit the scattering data: 12.57 Mev, $J^{\pi} = 1^{-}$ and 12.61 Mev, $J^{\pi} = 1^{-}$. None of the levels observed have reduced widths greater than 9% of the Wigner limit. (auth)

26646 EXACT TREATMENT OF PURE COULOMB DISTORTIONS IN (X,n) STRIPPING REACTIONS. Fernando B. Morinigo (California Inst. of Tech., Pasadena). Phys. Rev., 134: B1243-7(June 22, 1964).

Simple analytic formulas are obtained to express the amplitudes for stripping a particle into an orbit of arbitrary L value, using a Coulomb wave to describe the relative motion of the incident particles and a plane wave to describe the relative motion of the products. This approximation may be appropriate for the description of (X,n) reactions, where X is any charged projectile, and n is a neutron, particularly when the incident energy is well below the Coulomb barrier. Initially, the neutron is assumed to be bound to a particle that is later captured by the target; the wave function of this initial bound state is taken to be asymptotic and of zero orbital angular momentum, of the form $e^{-\alpha r}/r$. The resulting nucleus is described as a bound state of two particles moving with arbitrary relative orbital angular momentum L; the radial wave function of this bound state may be taken to be of the form $r^{L-1}(e^{-\beta r} - e^{-\beta' r})$. The cross sections predicted by these amplitudes are compared to the cross sections predicted by the analogous plane-wave Born approximation, and graphs are shown for a representative case. The qualitative appearance of the angular distribution is found to be much the same in both cases; however, the Coulomb-wave calculation predicts cross sections of smaller magnitude with previously assigned values of the reduced widths. (auth)

26647 COMPETITION BETWEEN NEUTRON AND GAMMA-RAY EMISSION FOLLOWING FORMATION OF THE COMPOUND NUCLEUS Po^{210} IN THE SYSTEMS $Pb^{206} + \alpha$ AND $Bi^{209} + p$. J. Robb Grover (Brookhaven National Lab., Upton, N. Y.) and Richard J. Nagle. Phys. Rev., 134: B1248-62(June 22, 1964). (BNL-7771)

Measurements of the cross-section ratio $R_x = \sigma(^{208}Po)/[\sigma(^{208}Po) + \sigma(^{209}Po)]$ are reported for the reactions $^{206}Pb(\alpha,n)^{209}Po$, $^{206}Pb(\alpha,2n)^{208}Po$, and $^{209}Bi(p,n)^{209}Po$, $^{209}Bi(p,2n)^{208}Po$ for bombarding energies up to 2.7 and 2.3 Mev above the respective α,2n and p,2n thresholds. The shape of R_α as a function of energy is clearly different from the shape of R_p. Moreover, using threshold energies determined internally by extrapolation of the data it is shown that $R_\alpha > R_p$ at any given excitation energy of the ^{210}Po compound nucleus over the entire range of energies studied. Despite this observed dependence of decay on the mode of formation, it is found that the results are completely consistent with the compound nucleus mechanism if the competition between gamma-ray emission and neutron emission and the different distributions of angular momenta characterizing the compound nucleus ^{210}Po for the two different target-projectile systems are taken into account. From a detailed analysis of the data nearest threshold the value of the level density parameter a is found to be about 11 Mev^{-1} (to within about ±20%), in agreement with values of a from other types of data in the mass region A = 204 to 210. An estimate for the ratio of mean radiation width to mean level spacing in ^{209}Po at excitation energies near the neutron binding energy is found, which agrees well with the value expected from systematics. Measurements of the ratio $R_\gamma = \sigma(^{210}Po)/[\sigma(^{208}Po) + \sigma(^{209}Po) + \sigma(^{210}Po)]$ where the ^{210}Po is formed in the $^{209}Bi(p,\gamma)^{210}Po$ reaction are reported. (auth)

26648 DIFFERENTIAL RANGE STUDY OF PRODUCTS FORMED BY 2.9-Gev PROTON IRRADIATION OF SILVER. J. B. Cumming, S. Katcoff, N. T. Porile, S. Tanaka, and A. Wyttenbach (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 134: B1262-9(June 22, 1964). (BNL-7762)

Thin silver targets (≈0.1 mg/cm²) were irradiated with 2.9-Gev protons. The recoiling products were collected in a stack of thin plastic films at 90° to the beam, at a geometry of 2π. By radiochemical separation ^{85}Sr, ^{61}Cu, ^{64}Cu, ^{43}Sc, ^{44}Sc, ^{42}K, ^{43}K, and ^{24}Na were removed from the films. Range distributions were obtained for each, and from these the corresponding energy spectra and velocity spectra were deduced. The mean energies are: ^{85}Sr – 3.2 Mev, ^{61}Cu and

^{64}Cu – 5.9 Mev, ^{43}Sc and ^{44}Sc – 9.4 Mev, ^{24}Na – 18.1 Mev. Comparison of the observed spectra with the results of Monte Carlo cascade-evaporation calculations showed excellent agreement for all of the products except ^{24}Na. It is concluded that the former are mainly spallation residues while ^{24}Na is formed by the splitting of a parent nucleus into two fragments. All of the energy spectra are very broad and there is no sharp difference between spallation-type spectra and two-body breakup type spectra. (auth)

26649 COMPARISON BETWEEN REACTIONS OF ALPHA PARTICLES WITH SCANDIUM-45 AND DEUTERONS WITH TITANIUM-47. K. L. Chen and J. M. Miller (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 134: B1269-80(June 22, 1964). (BNL-7740)

The excitation functions for the (α,n), $(\alpha,2n)$, $(\alpha,2p)$, $(\alpha,\alpha'n)^m$, $(\alpha,\alpha'n)^g$, and $(\alpha,2pn)$ reactions of ^{45}Sc and the (d,n), (d,2n), (d,2p), $(d,\alpha n)^m$, and $(d,\alpha n)^g$ reactions of ^{47}Ti were measured for alpha-particle energies from 15 to 40 Mev and for deuteron energies from 4 to 20 Mev. The alpha-particle excitation functions can be successfully fitted by a calculation based upon compound-nucleus theory; but the calculation is less successful in reproducing the deuteron excitation functions. The divergences between calculation and observation are in a direction that is to be expected from the contribution of deuteron stripping reactions. Despite the indications that the deuteron-induced reactions have substantial noncompound contributions, the ratio of the cross sections for the $(\alpha,2p)$ and $(\alpha,2n)$ reactions have the same dependence upon the excitation energy of the compound system as has the corresponding ratio for the (d,2p) and (d,2n) reactions. (auth)

26650 TOTAL NEUTRON CROSS SECTION OF Cm^{244}. R. E. Coté, R. F. Barnes, and H. Diamond (Argonne National Lab., Ill.). Phys. Rev., 134: B1281-4(June 22, 1964).

The total neutron cross section of ^{244}Cm was studied from 0.01 to about 900 ev with a fast chopper. Resonance parameters are given for many of the approximately 20 resonances observed below 500 ev. Three resonances were assigned to ^{246}Cm, but none to ^{245}Cm although this isotope was about as abundant as the ^{246}Cm in one of the samples studied. The value of the strength functions of ^{244}Cm and ^{246}Cm, when combined with other measured values, suggests that this quantity has a maximum near A = 239. (auth)

26651 PHASES OF PARTIAL MATRIX ELEMENTS AND THE PARITY RULE FOR INELASTIC SCATTERING. I. E. McCarthy (Univ. of California, Davis). Phys. Rev., 134: B1285-8(June 22, 1964).

It is shown that the phases of the partial matrix elements in the distorted-wave Born approximation, which are responsible for effects like forward and backward peaks in angular distributions, are closely related to the elastic scattering phase shifts for the entrance and exit channels and hence largely independent of the particular optical model used to calculate the wave functions. Phase considerations are used to verify the parity rule for even angular momentum transfer, and the conditions under which it is expected to hold are discussed. (auth)

26652 VARIATION OF NUCLEAR SPIN POLARIZATION TIME WITH EXCITATION OF ELECTRON RESONANCES. G. E. Schacher (Rutgers Univ., New Brunswick, N. J.). Phys. Rev., 135: A185-90(July 6, 1964).

In solid dielectric materials where nuclear and electron spins are coupled by dipolar interaction, positive and negative enhancements of the nuclear polarization are produced by inducing simultaneous electron-nuclear transitions (double-flip transitions). The nuclear polarization time τ_N is defined to be the time constant associated with the approach of the nuclear-spin system to the enhanced state. The proton polarization time of several such materials was measured, and it was found that τ_N is less than the thermal relaxation time when double flips are induced and greater, sometimes by two orders of magnitude, when the central electron resonance is excited. The first effect is understandable from the spin polarization rate equations. It is expected, qualitatively, that the second effect can be explained by a decoupling of electron and proton spins due to stirring of electron spins by the applied rf field; such an explanation is shown to be incorrect. (auth)

26653 COMPARISON OF THE ^{16}O(p,t) AND (p,^{3}He) REACTIONS POPULATING ANALOG FINAL STATES IN ^{14}O AND ^{14}N. Joseph Cerny and Richard H. Pehl (Univ. of California, Berkeley). Phys. Rev. Letters, 12: 619-21 (June 1, 1964).

To provide a sensitive experimental test of the charge independence of nuclear forces by detailed comparative measurements of direct interaction transitions from an initial state to analog final states, the ^{16}O(p,t)^{14}O (g.s., 0^+, T = 1) and ^{16}O(p,^{3}He)^{14*}N (2.31 Mev, 0^+, T = 1) transitions at 43.7 Mev were investigated. The excellent agreement between experimental and theoretical values of the absolute cross sections and the angular distributions implies a strongly charge-independent interaction operator. (M.J.T.)

26654 DETERMINATION OF THE HALF LIVES OF THE FIRST EXCITED STATES IN THALLIUM 203 AND THALLIUM 201 APPLYING THE THIRD MOMENT METHOD. Ekbal Bashandy (Egyptian Atomic Energy Establishment, Cairo). Proc. Math. Phys. Soc. (U.A.R.), No. 25, 97-9(1961).

The half lives of the 279-kev and the 330-kev first excited states in ^{203}Tl and ^{201}Tl, respectively, were recalculated using the third moment method. The same experimental data were used as before for evaluating the lifetimes of the states from the comparison and self-comparison methods. In order to reduce the influence of energy-dependent instrumental time delays in the previous calculation, the interpolation method was applied. The results were in good agreement with previous determinations. (auth)

26655 LIFETIME MEASUREMENTS OF THE 113-kev FIRST EXCITED LEVEL IN Hf^{177}. Ekbal Bashandy and M. S. El-Nesr (Atomic Energy Establishment, Cairo). Proc. Math. Phys. Soc. (U.A.R.), No. 25, 109-19(1961).

The half life of the 113-kev first excited level in ^{177}Hf was measured by a delayed coincidence technique. An electron-electron coincidence spectrometer was used for the energy resolution. A Th–B source was used in the experiment for comparison, in which a prompt curve was obtained which has exactly the same energies as the delayed curve. Three different methods for calculating the half life were applied. A half life of $4.3 \pm 0.2 \times 10^{-10}$ sec was obtained, in good agreement with that estimated by the unified nuclear model. (auth)

26656 INTERFERENCE BETWEEN RAYLEIGH AND NUCLEAR RESONANT SCATTERING IN SINGLE CRYSTALS. P. J. Black, G. Longworth, and D. A. O'Connor (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London), 83: 925-36(June 1964).

Black, Evans and O'Connor developed the theory of the interference between Rayleigh and nuclear resonant scattering and presented experimental results for polycrystal-

line scatterers which showed a general qualitative agreement with the theory. Measurements were made on the scattering within Bragg peaks of ^{57}Fe gamma rays from a single crystal of natural iron. These are presented and interpreted in terms of a more sophisticated theory due to O'Connor and Black. The results give a satisfactory quantitative confirmation of the theory. (auth)

26657 A MEASUREMENT OF THE DEBYE-WALLER FACTOR FOR ELASTIC NUCLEAR RESONANT SCATTERING OF ^{57}Fe GAMMA RAYS. P. J. Black, G. Longworth, and D. A. O'Connor (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London), 83: 937-40(June 1964).

The recoilless fraction for the elastic nuclear resonant scattering of gamma rays was investigated by measuring the temperature dependence of the interference between the elastic scattering of 14.4 kev ^{57}Fe gamma rays by the resonant nuclei and by the electrons in a single crystal of natural iron set for the (110) Bragg reflection. The measurements confirm that the recoilless fraction for nuclear resonant scattering is given by the product of the separate recoilless fractions for absorption and emission and not by the corresponding factor for atomic Rayleigh scattering, usually known as the x-ray Debye-Waller factor. (auth)

26658 THE THEORY OF THE NUCLEAR RESONANT AND ELECTRONIC SCATTERING OF RESONANT RADIATION BY CRYSTALS. D. A. O'Connor and P. J. Black (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London), 83: 941-8(June 1964).

The electronic and nuclear resonant scattering of gamma rays by a monatomic crystal was calculated using a simple classical model and neglecting extinction effects. The scattering due to interference between the electronic and nuclear systems has an elastic and an inelastic component, and the angular distribution of the latter differs from the distribution of the inelastic Rayleigh component. The elastic part of the interference scattering is concentrated in Bragg diffraction peaks provided only that the crystal is ordered atomically. Disorder in the nuclear structure of the crystal, however, results in the purely resonant scattering being distributed between a coherent and an incoherent component. Types of disorder considered are those due to dilution of the crystal with nonresonant nuclei, random distribution of nuclear ground states in a magnetic crystal, and random distribution of line shifts in a naturally broadened crystal. (auth)

26659 NEW LEVEL IN ^{24}Na WITH AN EXCITATION ENERGY OF 2.152 Mev. Ma. Esther O. de Lopez (Universidad Nacional de Mexico, Mexico City). Rev. Mex. Fis., 12: 159-60(1963). (In Spanish)

A level with an excitation energy of 2.512 ± 0.005 Mev was found in the spectrum of ^{24}Na through (d,p) reactions in ^{23}Na using a 1.51-Mev deuteron beam. Angular distribution analysis of the ground state and the sixteen levels of lowest excitation in ^{24}Na is in progress. (auth)

26660 EQUIVALENT ATOMIC NUMBER OF COMPLEX TARGETS FOR SATURATION BACKSCATTERING OF ELECTRONS. M. F. Laranjeira (Centro de Estudos de Fisica Nuclear (I.A.C.), Comissao de Estudos de Energia Nuclear, Lisbon). Rev. Port. Quim., 5: 58-64(1963).

It is shown, by simple theoretical means, that the formula empirically proposed by J. Saldik and A. O. Allen is the most advisable one for the equivalent atomic number of a complex target, at least for relativistic energies of the incident electrons up to a few Mev. R. H. Muller's formula may be regarded, it is shown, as a first approach, only suitable for targets not containing hydrogen. (auth)

26661 ON THE DECAY OF THE Si^{28} LEVELS EXCITED AT THE 1002 kev, 1024 kev, 1089 kev, 1096 kev AND 1117 kev $Al^{27}(p,\gamma)Si^{28}$ RESONANCES. Martti Koskelin (Univ. of Helsinki). Soc. Sci. Fennica, Commentationes Phys.-Math., 29: No. 6, 7-46(1964).

The gamma decay of ^{28}Si levels excited at 1002, 1024, 1089, 1096, and 1117 kev in ^{27}Al(p,γ)^{28}Si was investigated with a scintillation spectrometer. Gamma singles and coincidence spectra and angular distributions and correlations were measured. Decay schemes and spin and parity assignments of 4^+, 2^+, 3^-, and 4^- for the resonance levels excited at the 1002, 1024, 1089, and 1096 kev resonances, respectively, are proposed. On the basis of measured angular distributions and correlations, it seems probable that two closely spaced ^{28}Si levels are excited at 1117 kev. At the 1024-kev resonance, evidence for a new level in ^{28}Si at 11.07 ± 0.03 Mev was found. (auth)

26662 THE MEASUREMENT OF SMALL UNORDERED SCATTERING CROSS SECTIONS WITH SUBTHERMAL NEUTRONS. R. Scherm (Kernforschungsanlage, Julich, Ger.) and W. Schmatz. Z. Naturforsch., 19a: 354-7(Mar. 1964). (In German)

A method for the exact, direct measurement of weak unordered scattering of neutrons is described and discussed with regard to its possibilities for use. The incoherent scattering cross sections of aluminum, bismuth, and beryllium were determined to be 10 ± 1, 12 ± 1, and 4 ± 1 mb, respectively. These values represent at least an upper limit for the spin-incoherent scattering cross section of these metals. (tr-auth)

26663 A SIMPLIFIED CALCULATION METHOD FOR THE OPTICAL NUCLEAR MODEL. Max Krell (Universitat, Erlangen, Ger.). Z. Naturforsch., 19a: 406-9(Apr. 1964). (In German)

According to the optical nuclear model the effective cross sections for the potential elastic scattering and absorption for neutrons were calculated up to energies of about 20 Mev. For this a simple calculation scheme was developed, which, without a great deal of trouble, yielded numerically exact values for the effective cross sections, and, further, was independent of the form of the potential. The potential expressions used in the calculations included two geometric parameters. The depth of the real potential demonstrated itself to be independent of atomic weight and energy, still the imaginary part must be provided with an empirically adjusted, energy-dependent factor. For the considered nuclei, ^{56}Fe, ^{118}Sn, and ^{209}Bi, a surprisingly good agreement between theory and experiment was obtained. (tr-auth)

26664 ANGULAR DISTRIBUTIONS AND EFFECTIVE CROSS SECTION OF THE REACTION $^{19}F(p,\alpha_0)^{16}O$ IN THE ENERGY REGION FROM 2.0 TO 3.3 Mev. G. Breuer and L. Jahnke (Physikaliche Staatsinstitut, Hamburg). Z. Naturforsch., 19a: 471-80(Apr. 1964). (In German)

Angular distributions and cross sections for the reaction $^{19}F(p,\alpha_0)^{16}O$ were measured for proton energies between 2 and 3.3 Mev, and the measurement data adjusted according to the Legendre polynomial. The calculation of the angular distribution according to the theory of Devons and Goldfarb for the special case of compound nucleus formation made possible the determination of the quantum states of some quasistationary levels in the compound nucleus ^{20}Ni, which is excited for $E_p > 2$ Mev in $^{19}F + p$. Values obtained were: 2.12 (2^+), 2.31 (2^+), and 2.55 Mev (1^+). For the upper half of the 2.6-Mev resonance data could be found for length, width, and cross section; on the quantum states of the proper levels in ^{20}Ne on qualita-

tive assertations were possible. A resonance at 2.82 Mev, which previously was found only for the α_π group, could also be established for the α_0 group. An excitation function measured under 90° agreed well with measurements by other authors. (tr-auth)

26665 THE L/K CAPTURE RATIO OF CHROMIUM-51. W. Heuer and E. Huster (Universität, Munster, Ger.). Z. Naturforsch., 19a: 517-18(Apr. 1964). (In German)

The method of Drever and Moljk was used to measure the L/K capture ratio for ^{51}Cr. This excited nucleus decays 91% to the ground state, and 9% to the 320-kev state of ^{51}V. For the transition of ^{51}Cr to the 320-kev state of ^{51}V, it was found that $N_L/N_K = 0.1044 \pm 2\%$, and for both transitions $N_L/N_K = 0.1033 \pm 3\%$. Theory and experiment agreed within the sources of error. (M.C.G.)

26666 GAMMA RADIATION FROM CAPTURE OF THERMAL NEUTRONS IN RHODIUM. Ulf Gruber (Technische Hochschule, Munich and Atomenergikomissionen, Risö, Denmark). Z. Physik, 178: 472-87(1964). (In German)

For measuring the energy and intensity of low-energy gamma radiation, which is emitted by the nucleus after capture of slow neutrons, a spectrometer with a bent crystal was built and installed in the DR-3 Reactor in Risö, Denmark. The gamma radiation was reflected on the (110) plane of a quartz crystal. Frequently reflections in the 2nd, 3rd, and 5th orders were measured, which yielded a higher measurement accuracy and a better resolution possibility than in the 1st order. The reflection possibilities of the (110)-plane were determined in the 1st, 2nd, 3rd, and 5th orders. It yielded at higher energies (in the 1st order at around 300 kev) an E^{-2} pattern, which was expected for a mosaic crystal. With the instrument the gamma spectra of ^{104}Rh was plotted and 164 lines found were measured. The results obtained were used with consideration of coincidence data to extend the energy level scheme proposed by Buschhorn. (tr-auth)

26667 NUCLEAR INTERACTIONS. Sergio DeBenedetti. New York, John Wiley & Sons, Inc., 656p. $16.00.

Theory for the interactions of nuclear particles is presented, together with the associated experimental foundations. Nuclear forces, scattering theory, nuclear models, nucleon interactions with radiation, nuclear reactions, relativistic fermion interactions with radiation, weak interactions, meson theory, Feynman diagrams, Dirac theory, multipole radiation, and quantization of the radiation field are covered. (D.C.W.)

26668 ELASTIC AND INELASTIC SCATTERING OF FAST NEUTRONS FROM MEDIUM WEIGHT NUCLEI. Salvatore George Buccino. Thesis, Durham, N. C., Duke Univ., 1963. 116p.

The energy spectra of neutrons scattered inelastically by Zr, Nb, Rh, Sb, Ag, Te, La, Ce, Pr, Gd, and Er have been measured using time-of-flight techniques. These measurements were performed at incident energies of 4.00, 5.00, 6.00, and 6.50 Mev. Nuclear temperatures and Fermi gas level density coefficients have been determined at each value of incident energy and compared with theoretical predictions. Angular distributions of 5.00 Mev neutrons elastically scattered by C, Nb, Zr, Sb, Ag, Ce, and Pr have been measured also. These distributions have been compared with optical model predictions based on local and nonlocal potentials. These comparisons indicate that better fits to the data can be obtained using a local potential rather than a non-local one. (Dissertation Abstr.)

26669 SHAPE OF THE $0^+ \rightarrow 0^+$ POSITRON SPECTRUM IN Ga^{66}. David Conrad Camp. Thesis, Bloomington, Ind., Indiana Univ., 1963. 81p.

A study of the beta spectrum of ^{66}Ga has been made with a 40 cm radius shaped magnetic field spectrometer. The shape of the high energy, intense positron spectrum of the ground state transition was examined in detail. From the arguments and experimental evidence presented in this study the shape factor for the $0^+ \rightarrow 0^+$ transition was fitted by the equation $S(W) = K(1 + 0.0328W + 0.354/W - 0.000419W^2)$. This fit to the data was made after the data were divided by an empirical factor of the form $(1 + 0.4/W)$. Without this empirical factor it is impossible to obtain consistent results. The coefficients in the above equation are explicitly determined by the value of the ratio of nuclear matrix elements. The nonstatistical shape for this group leads to an endpoint energy of 4.153 ± 0.003 Mev, and an intensity of 51.2%. The comparative half life (log ft = 7.903) is unusually large for an allowed transition and is presumably due to the small magnitude of the normal allowed matrix element entering the decay. In ^{66}Ga the initial and final nuclear states are expected to have different isotopic spins. Since the normal allowed matrix element $\langle 1 \rangle$ can only couple states of the same isotopic spin, this beta moment can only contribute to the decay to the extent of the admixture into the parent state of the analogous state of the daughter. The resultant strong depression of the nuclear matrix element $\langle 1 \rangle$ makes it meaningful to include in the theoretical shape factor the effect of the usually neglected matrix element $\langle \vec{\alpha} \cdot \vec{r} \rangle$. The inclusion of the empirical factor $(1 + 0.4/W)$ in the final shape factor suggests that the deviations found in this study and those found previously in the electron spectra of ^{114}In, ^{90}Y, and ^{32}P, and the positron spectra of ^{22}Na, ^{89}Zr, and ^{56}Co are associated with both the Gamow-Teller and Fermi parts of the beta interaction. When a nonstatistical shape deviating only slightly from a statistical shape is observed, precautions must be taken to ensure that such deviations are not a result of distortions introduced by any components of the measuring apparatus. The major possible sources for such deviations are the detector, the main center defining baffle in the spectrometer, and the background subtracted in the data analysis. All three were eliminated as sources for the nonstatistical shape observed. Four different detectors were used to observe the shape. A scintillation detector, and end window proportional counter operated at 15 and 20 cm of pressure, a side window proportional counter operates at 10 cm of pressure and a solid state counter. The shape factor results of all four counters were in excellent agreement with each other indicating that the "true" shape was being detected. If indeed the theoretical interpretation of the observed experimental shape presented in this study is correct, ^{66}Ga would represent one of the first beta decays in which higher order terms were both detected and identified in the presence of the normal allowed contribution. It is to be expected that in the future when even more precise experimental measurements are made, many more such examples of higher order contributions may be found and identified in allowed decays, and perhaps even in the forbidden decays. (Dissertation Abstr.)

26670 THE FISSION OF THORIUM AND RHENIUM INDUCED BY INTERMEDIATE ENERGY HELIUM IONS. Marshall Earl David. Thesis, Lafayette, Ind., Purdue Univ., 1963. 168p.

Targets of natural thorium (^{232}Th) and natural rhenium (37.07% ^{185}Re and 62.93% ^{187}Re) were bombarded with helium

ions up to energies of 40 Mev and the absolute yields of a number of fission products were determined radiochemically. In the case of thorium, the following observations are noted: 1. The mass-yield distribution is predominantly asymmetric through the energies studied with the yield of the symmetric mass region rising rapidly as excitation energy is increased. 2. A peak or irregularity exits in the mass-yield distribution around masses 113–115. 3. Evidence for fine structure seems to exist at mass 95 and in the valley region. 4. The average number of neutrons emitted per fission is less than that previously reported both for this compound nucleus and for the fission of other heavy elements of similar excitation energies. 5. The valley-to-peak ratios observed in this work are higher for a given excitation energy than those observed for the same compound nucleus formed by the reaction, $^{235}U + n$. This may be due to differences in angular momenta of the compound systems. 6. The nuclear radius parameter, r_0, is found to be 1.52 fermis when the sharp-cutoff potential of Blatt and Weiskopf and an "effective" helium-ion radius of 1.20 fermis is used. 7. A smooth mass-yield curve is produced by utilization of the constant-charge-ratio (CCR) hypothesis in determination of the independent yield corrections. Independent yields determined in this work fall within the limits of those found by others in a more concerted effort to check the validity of the CCR rule. Data collected on the fission of rhenium indicate: 1. The mass-yield curve produced by bombardment at 40 Mev appears to have a symmetric peak about A = 93 with a width at half height of 20 mass units. Peaks from asymmetric fission may be present (e.g. ^{133}I and ^{135}I) but further work will be necessary to verify this. 2. At incident helium-ion energies down to 35 Mev the cross sections drop more rapidly than previously reported with no evidence of the asymmetry about masses 109-112 observed previously in this laboratory. 3. The number of neutrons emitted per fission event appears to be between three and four. The significance of the above results are discussed and detailed descriptions of the experimental techniques used are given. (Dissertation Abstr.)

26671 ELASTIC AND INELASTIC SCATTERING OF FAST NEUTRONS FROM HEAVY WEIGHT NUCLEI. Clinton Edward Hollandsworth, Jr. Thesis, Durham, N. C., Duke Univ., 1963. 126p.

The energy spectra of neutrons scattered inelastically from Ta, W, Pt, Au, Hg, Tl, RPb, Bi, Th, and U have been measured using time-of-flight techniques. The measurements were made for incident neutron energies of 4.00, 5.00, 6.00, and 6.50 Mev. Nuclear temperatures and Fermi gas level density coefficients have been determined at each value of incident energy and compared with theoretical predictions. The results indicate that the Fermi gas model provides a good description of the variation of average nuclear level densities with excitation energy for all nuclei studied, except those near closed shells where the constant temperature approximation seems valid. Angular distributions of 5.00 Mev neutrons elastically scattered from Ta, Au, Tl, RPb, Th, and U have been measured and compared with optical model predictions based on a local potential with variable parameters and the non-local potential of Perey and Buck. The results indicate that the data are described reasonably well by either potential. (Dissertation Abstr.)

26672 PROPERTIES OF (p,n) REACTIONS IN TENUOUS GASES. Paul Blair Parks, III. Thesis, Durham, N. C., Duke Univ., 1963. 83p.

A cryogenic target chamber has been developed for the production of very thin, but uniform, targets to be used with accelerated charged particle beams. The target reaction chamber is appended to a cryostat which is capable of containing liquid helium as the primary refrigerant. The temperature of this chamber can be adjusted so that condensation of the gas in the vicinity of the beam path is eliminated. The cryostat freezes out the gas which escapes the reaction chamber. To date, this new cryogenic technique was used to study the (p,n) reactions of ^{11}B, ^{40}Ar, and ^{37}Cl, and also the D(d,n) reaction. Very narrow resonances (widths ≤ 450 ev) are discovered in the $^{40}Ar(p,n)^{40}K$ reaction near the neutron threshold. It is found that the narrower resonances show decided asymmetries which seem independent of target density over the range investigated. The importance of the larger energy losses in ionizing K and L shell electrons is stressed. The majority of these large losses are thought to possibly occur in the atom containing the nucleus with which the proton reacts. The narrowest resonances have apparent widths at half maximum of 140 ev. This leads to an upper limit on the incident beam spread of about 125 ev. The target thickness appears to be about 100 ev. Use of the T(p,n) reaction as a neutron source is proposed and estimates of the resolving power attainable with this reaction in the cryogenic system are reported. (Dissertation Abstr.)

26673 A STUDY OF THE $N^{14}(d,n)O^{15}$ REACTION. William Woody Rolland. Thesis, Durham, N. C., Duke Univ., 1963. 116p.

Angular distributions of the neutrons emergent from the $^{14}N(d,n)^{15}O$ reaction were measured at the deuteron bombarding energies of 2.487, 3.097, and 3.564 Mev. The neutrons arising from the formation of different levels in the residual nucleus ^{15}O were separated by the use of time-of-flight spectroscopy employing two-fold pulsing of the incident deuteron beam. These measurements were made with the Duke University 4 Mv pulsed Van de Graaff accelerator. Use of a nitrogen gas target made it possible to obtain absolute cross sections. Plane wave calculations were made for all the neutron groups observed. Distorted wave calculations were made for the ground state and third excited state in an attempt to fit the measured angular distributions. Neutrons leading to the formation of ^{15}O in its ground, third, sixth, and seventh excited states were resolved. The following assignments for the angular momentum l_p of the captured protons were made: $l_p = 1$ for the ground state, $l_p = 1$ for the third excited state, $l_p = 2$ for the sixth excited state, and $l_p = 0$ for the seventh excited state. The distributions obtained for the unresolved first and second excited states indicate that one of these may be formed by $l_p = 0$ and the other by $l_p = 2$. The unresolved distributions for the fourth and fifth excited states indicate that at least one of these states (and possibly both) is formed by $l_p = 0$ Measurements of the yields of neutrons from the reaction for incident deuteron bombarding energies of 1.4–3.8 Mev indicate broad resonance-like peaks which may be due to compound nucleus formation or to distortion effects in the direct interaction process. (Dissertation Abstr.)

26674 PHOTOPROTONS FROM CARBON. Yong-Moo Shin. Thesis, Philadelphia, Univ. of Pennsylvania, 1963. 136p.

The photoproton cross section of ^{12}C was measured from 20.2 Mev to 22.4 Mev using monochromatic gamma rays from the $^3T(p,\gamma)^4He$ reaction. The energy of the gamma ray was varied by changing the energy of the incident protons. The gamma rays were monitored by a 3-inch diameter by 4-inch long sodium iodide crystal. A 2-inch diameter by ½-inch thick anthracene crystal was used for both

the irradiated sample and the proton detector. The protons originating in the anthracene crystal were identified by a pulse shape discrimination technique. The peak energy of the giant resonance was found to be equal to or greater than 22.4 Mev and the cross section at 22.4 Mev was found to be 13.1 mb. The cross section curve showed structure at 20.57 Mev, 20.95 Mev, and 21.38 Mev with integrated cross sections of 0.3, 0.6, and 1.2 Mev-mb respectively. The cross section curve also suggested structure in the vicinity of 20 Mev and 22 Mev. The energy dependence of the cross section, as conjectured from (γ,p) reaction, seems to differ from that of (γ,n) reaction. The results appear to support the assumption that the impurities of the isotopic spin states vary from one state to another. They would, otherwise, suggest a more complicated picture for the ^{12}C photonuclear reaction. (Dissertation Abstr.)

26675 INVESTIGATION OF (d,α) REACTIONS ON Be^9, N^{14}, F^{19}, AND P^{31}. Robert John Wilson. Thesis, St. Louis, Washington Univ., 1963. 56p.

The interpretation of the angular distributions of emergent particles from nuclear reactions using deuterons as the incident particles has proved to be a very useful tool of nuclear spectroscopy. Particularly, the explanation of the forward peaking, along with a secondary maximum, in the distribution of protons from the (d,p) reaction by means of a direct interaction mechanism (the deuteron stripping process) has yielded many spins and parities of the contributing nuclear states. Since many of the (d,α) angular distributions exhibited a forward peaking with following oscillations, it was thought that this more complicated reaction might be amenable to interpretation by a similar direct interaction mechanism. Neglecting all but the simplest interactions, theoretical (d,α) angular distributions were calculated using the plane wave Born approximation. Three simple processes employed in order to predict the forward maxima in the experimental distributions were: 1. the "pickup" process, wherein the incident deuteron is assumed to pick up another deuteron at the surface of the target nucleus to form the emergent alpha particle, leaving the residual nucleus behind. 2. the "knock-out" process, wherein the incident deuteron is assumed to knock out the emergent alpha particle from a core, and is then captured by the core to form the final nucleus. 3. the two nucleon "pickup" process, wherein the incident deuteron is assumed to pick up a neutron and proton from single particle states in the initial nucleus to form the emergent alpha particle. leaving the final nucleus behind. Calculations for the two nucleon process, as considered by Glendenning (Gl 62), were carried out only for the ground state distributions. Many of the angular distributions exhibited a backward increase. In order to explain the backward peaking, a contribution from heavy particle stripping was added to the calculated distributions. Heavy particle stripping envisages the projectile as interacting with the "core" of the target nucleus, composed of a core plus an alpha particle, thereby "stripping" the core from the target nucleus and releasing the alpha particle. The alpha particle continues in the original direction of the motion of the target nucleus in the center of mass reference frame, which is the backward direction; thus, the cross section will be enhanced in the backward direction. A description of the experimental procedure is given, including a discussion of the preparation of thin targets and the use of solid state detectors. Particular emphasis is given to a discussion of the high resolution capabilities of the solid state detectors in conjunction with their ability to discriminate against long range reaction products while detecting short range alpha particles. In the conclusion, it is pointed out that the agreement of the theoretical distributions with the data is generally inferior to that obtained from the (d,p) reactions by the corresponding stripping theory. Finally, it is judged that a more incisive analysis than that employed by Butler for the (d,p) reactions is required to explain the results of these experiments. (Dissertation Abstr.)

26676 LEVEL CROSSINGS IN MERCURY. Ronald Dean Kaul. Thesis, Cleveland, Case Inst. of Tech., 1963. 72p.

The value of g_j for the 6s6p $^3P_1$ state of mercury was determined by measurements of the positions of the "level crossing" in ^{199}Hg and the four "level crossings" in ^{201}Hg. After second order corrections for perturbations by the other states of the 6s6p configuration the values of g_j calculated for the two isotopes were $g_j(^3P_1) = 1.486147(10)$ for ^{199}Hg and $g_j(^3P_1) = 1.486156(18)$ for ^{201}Hg. With second order corrections good internal consistency was found between the four crossing points in ^{201}Hg. "Coherence narrowing" of the ^{199}Hg $^3P_1$ state crossing was investigated. The level crossing in the $^1P_1$ state of ^{199}Hg was also observed. (Dissertation Abstr.)

26677 RECOIL PROPERTIES OF FISSION PRODUCTS FROM URANIUM BOMBARDED WITH Mev PROTONS. Victor Emil Noshkin, Jr. Thesis, Worcester, Mass., Clark Univ., 1963. 125p.

Recoil methods were used to measure the range, anisotropy parameter, and forward component of velocity (of the struck nucleus) for many fission fragments resulting from 45- and 150-Mev proton fission of ^{238}U. A new range-energy relationship based primarily on that of Lindhard, Scharff, and Schiøtt is proposed. The equation, which appears to work well in predicting the energy from range measurements of fragments in thermal-neutron fission of ^{235}U, was used to calculate fragment kinetic energy at 45- and 150-Mev. The average excitation energy deposited in the struck nucleus leading to the formation of a specific fragment is calculated using a "two-nucleon collision" model. The total kinetic energy release for products near symmetry at 150-Mev was found to be greater than that of symmetric products in the thermal-neutron fission of ^{235}U. This increase is attributed to greater neutron evaporation from the heavy nucleus prior to fission. Many of the observed recoil properties could be described in terms of the $n/\overline{Z}$ ratios of the fragments, where $\overline{Z}$ is the most probable charge leading to the formation of a specific fragment and $\underline{n}$ is the difference between the mass number and $\overline{Z}$. An observed product with a low $n/\overline{Z}$ ratio may be complementary to a fragment with a high $n/\overline{Z}$ ratio. There is a general trend of decreasing excitation as $n/\overline{Z}$ increases. Many observed events, with low deposition energy (on the average) and high $n/\overline{Z}$ ratios, may also be formed in high deposition events in which the complementary fragment has an unusually low $n/\overline{Z}$ ratio. The anisotropy parameter appears to be a function of the $n/\overline{Z}$ ratio of the fragments as well as of their masses. A comparison of the $n/\overline{Z}$ ratios of the products and the n/p ratio of the most probable fissioning nucleus indicated that the primary fragments are probably formed in the same mass-to-charge ratio as the fissioning nucleus. The controversy whether unchanged-charge-distribution hypothesis is a superior one at high energies for all modes of fission could not be resolved. It is consistent with the data. A total kinetic energy release in 150-Mev fission, averaged over measured products, agrees well with other published data. As others have shown previously, an increase in

bombarding energy does not appreciably affect the total energy release. (Dissertation Abstr.)

26678 AN EXTENDED OPTICAL MODEL. John Gordon Wills. Thesis, Seattle, Univ. of Washington, 1963. 163p.

Calculations were made of elastic and inelastic scattering of spinless charged projectiles by even-even nuclear targets and the subsequent emission of gamma rays. All calculations have been performed employing a collective model to describe the internal degrees of freedom of the target nuclei. In particular, the nucleus is described in terms of monopole (breathing) oscillations, or quadrupole vibrations, or rotations of a permanently deformed (spheroidal) nucleus. The interaction between the projectile and the target is given by a complex potential, the size and shape of which are functions of the target internal coordinates. This is a generalization of the very successful optical model which is used for the calculation of elastic scattering. The problem involves the solution of a set of simultaneous differential equations. The basic calculational approximation involves a limitation on the number of nuclear states considered. (This is called the Tamm-Dancoff approximation.) Some numerical tests have been made of the Tamm-Dancoff approximation which demonstrate the rapid convergence of this approach. Numerical comparisons have been made with other types of approximations to the same nuclear model. (The present work, however, is the definitive one.) These include the first order distorted wave Born approximation and semi-phenomenological theory of Austern and Blair. Differences are noted in both cases. Experimental measurements on the scattering of alpha particles have been analyzed in terms of the model. The calculations represent an extension of the work of Chase, Wilets, and Edmonds, who solved coupled equations for spinless neutrons in a rotational optical model. It is similar to recent work reported by Buck, but it is shown that coupling terms omitted by Buck are significant. Calculations performed under identical assumptions yield agreement between the two works. The solution of coupled equations is not only a proper method of calculation of the stated nuclear model, it is also (to date) the only practical method of solution of highly excited states. Although the first order distorted wave Born approximation gives moderately good results for excitation of the first excited level, it is in no way feasible for higher excitations. Further extensions of the method are discussed. (Dissertation Abstr.)

26679 AN INVESTIGATION OF THE NUCLEAR MOMENTS IN BETA-RADIATION. Chung-wook Kim, Thesis, Bloomington, Ind., Indiana Univ., 1963. 93p.

A survey is made of the information about nuclear states which can be deduced from the experimental data of beta decay in the form of comparative half life, (ft) values. First, the results of the single-particle model of nuclear behavior have been brought up to date, and the application of the single-particle model is extended to the first forbidden transitions. The most immediate finding is that the long-known suppression of an order of 10–100 of normal allowed decay rates relative to single-particle expectations is paralleled by suppressions of the same order among the forbidden transitions. Another significant finding is that a correlation between certain suppressions of mirror decay rates and enhancements of l-forbidden transitions involving similar nucleonic configurations can be established and this can be explained as arising from the same mixing of orbital angular momenta. This leads to the deformed core description of nucleus, in which the mixing of l values arises in a natural way. As indicated in the recent investigations in connection with nuclear reactions, the deformed core model is shown to be applicable to even quite light nuclei, which have usually been treated introducing intermediate coupling parameters. The application of the deformed core model to the super-allowed transitions indicates that both the initial and final nuclear deformations in some mirror nuclei are quite large, but are about the same and it is this, rather than an absence of deformations, which accounts for the small suppressions in these cases. The large suppression among the normal allowed transitions can be attributed to the different core deformations found for the initial and final states, leading to their mismatch in evaluating the beta moments. A large part of the suppression factors among the forbidden transitions can thus be accounted for. Quantitatively, the improvement of the deformed core model over the single-particle model is striking; for example, the discrepancy between theory and experiment for the normal allowed transitions is reduced from the suppression factor $10^{1.7}$ to a factor of around $10^{0.3}$. In some cases, the agreement of the deformed core theory with experiment is quite complete. It should be emphasized that independent evidence on observed nuclear magnetic and electric moments is insisted upon for every case. The considerations are thus restricted to a more limited number of cases, but make them a significant test of the theory. Finally, theoretical relationships between beta moments and corresponding gamma moments are derived. Direct relationships for cases in which the parent states of beta and gamma decays are members of the same isomultiplet are generalized, and corrections for the effects which tend to destroy charge independence are taken into account. The application of these results to the few available cases tends to show that the Conserved Vector Current hypothesis is essential if the Ahrens-Feenberg estimates of nuclear potential effects are correct, but this type of evidence is not incontestable because estimates like Pursey's give equal agreement without the hypothesis. (Dissertation Abstr.)

26680 NEUTRON-GAMMA ANGULAR CORRELATION IN THE $B^{11}(d,n\gamma)C^{12}_{4.43}$ REACTION. Wei-feng Huang. Thesis, Charlottesville, Va., Univ. of Virginia, 1963. 108p.

Some experimental findings are presented from neutron-gamma correlation measurements of the $^{11}B(d,n\gamma)^{12}_{4.43}C$ reaction at incident deuteron energies of 0.97 Mev and 0.68 Mev. The experimental technique employed a fast neutron time-of-flight spectrometer, using a Green-Bell type time-to-pulse height converter with a modified supervisory coincidence circuit. The targets were of enriched ^{11}B(98.6%) deposited on tantalum backings 0.5 mm thick. The target used with an incident deuteron energy of 0.97 Mev was about 70 kev thick, and the target used with an incident deuteron energy of 0.68 Mev was about 140 kev thick. The mean deuteron energies (as weighed by the yield curve) were 0.94 Mev and 0.62 Mev respectively. A 5 inch by 5 inch cylindrical plastic scintillator (NE 102), mounted on a RCA 6342A photomultiplier, was used for the neutron detector, and a light pipe of conical shape coupled the scintillator to the 2 inch photomultiplier. The scintillator for the gamma detector was a $1\frac{1}{2}$ inch diameter by 1 inch cylindrical NaI(Tl) crystal enclosed in a brass holder and mounted on a RCA 6342A photomultiplier. NaI gives slower-rising pulses than the plastic; however, its better energy resolution was needed for energy selection in the side for this experiment. The neutron flight path was set to be 0.9 meter. A current integrator, measuring the

charge collected on the target, was used as the primary monitor. A separate 2 inch by 2 inch cylindrical plastic scintillator was used also to monitor pulses greater than those corresponding to 3 Mev neutrons. The counting rates in both of these monitors, together with the one in the fixed neutron counter, served to check on the target conditions and the stability of the electronics used in the experiment. Correlation measurements were carried out in two geometries for both deuteron energies. In the first arrangement the gamma detector was placed along $\bar{k}_d \times \bar{k}_n$, that is, perpendicular to the reaction plane, and the position of the neutron detector was varied in the reaction plane. Such a correlation approximates the neutron angular distribution. In the second arrangement both detectors were in the reaction plane, and the position of the gamma detector was varied for a given neutron angle. Measurements taken in the reaction plane were analyzed by a Burroughs 205 computer for the least-square fitting of the function $W = A_0 + A_2\cos(\phi - \phi_0)$. The measured correlations of the first type show good agreement with reported measurements of the neutron angular distribution. Results of correlations in the reaction plane were treated by the $l_p = 1$ DWBA theory of Stachler and Tobocman. However, it was found that the determination of the distortion parameter λ with reasonable error would in some cases require an almost unattainable experimental accuracy. An additional uncertainty also arose from the fact that correlation data in the reaction plane showed a strong component with a periodicity of 90°. Previously reported work on this reaction at $E_d = 2.65$ and 5.35 Mev did not show a significant P_4 term in the angular correlations. A computer program, analyzing the data in terms of higher order fitting, is being completed. Viewed from the distorted wave stripping theory, the higher complexity would require a mode with an angular momentum transfer of 3, in addition to the commonly accepted mode with $l_p = 1$. However, compound nucleus contributions are the more likely source of the higher order terms in the correlation. (Dissertation Abstr.)

26681 ELASTIC SCATTERING OF He^3 AT 20 Mev. Raymond Wallace Klingensmith. Thesis, Columbus, Ohio, Ohio State Univ., 1963. 110p.

Absolute differential elastic scattering cross sections were measured for the scattering of 20 Mev ^{3}He particles from V, Ni, Cu, Rh, ^{118}Sn, Sm, Yb, and Pb. Where practical, the measurements were made at laboratory angles extending from 20 degrees to 170 degrees. The diffraction-like oscillations exhibited by the elastic-to-Coulomb cross section ratios are not highly pronounced. A preliminary optical model analysis was carried out using the HUNTER automatic search code of Drisko and Bassel. Saxon-Saxon potential with Thomas type spin-orbit coupling was considered. Reasonable fits to the data were obtained. (Dissertation Abstr.)

26682 DEUTERON CAPTURE IN C^{14}. John Berger Nelson, Jr. Thesis, Austin, Tex., Univ. of Texas, 1963. 79p.

The reaction $^{14}C(d\gamma)^{16}N$ has been previously reported by a group at Wisconsin, and the cross section was set at 600μb at $E_d = 2.0$ Mev. In view of this surprisingly high cross section, an investigation was undertaken to confirm their data. No evidence for the reaction was found in the bombarding region $1.0 < E_d < 1.6$ Mev, and the estimated upper limit for the cross section in this region is 10 ± 5μb. However, positive evidence was obtained for the reaction in the region of $E_d = 2.0$ Mev, where the $^{14}C(dp)^{15}C$ and $^{14}C(dn)^{15}N$ reactions are known to show maxima in their excitation functions. The measured cross section in this region is, however, only 10 ± 5μb; this is down by a factor of sixty from the value reported from Wisconsin. Theoretical considerations relative to the data are presented. It is speculated on the basis of experience that the reaction $^{23}Na(d\alpha)^{20}F$ (which would occur in a NaI detector) may have produced ^{20}F, the decay of which was mistaken for ^{16}N decay. It was also found that the half life of ^{15}C, on which some of the results are based, is 2.5 ± 0.1 seconds; this is 11 higher than the most recently reported value. (Dissertation Abstr.)

26683 BETA–GAMMA DIRECTIONAL CORRELATION STUDIES OF La^{140}. Richard Dodds Murphy. Thesis, Bloomington, Ind., Indiana Univ., 1963. 160p.

The beta-gamma directional correlation coefficient, $\epsilon(W)$, associated with the 2.2 Mev beta-1.6 Mev gamma cascade in the decay of ^{140}La has been determined at ten beta-ray energies in the range from 1.7 to 2.0 Mev. By combining the results of this experiment with existing data on the spectrum shape correction factor, C(W), and the beta-circularly polarized gamma correlation coefficient, it has been possible to determine the nuclear matrix elements of the $3^- - 2^+$ outer group beta transition. In selecting beta-gamma coincidence events, energy discrimination of both radiations preceded coincidence detection. Special pulse shaping circuits were provided to permit use of coincidence resolving times of 30 to 50 mμ sec. Nevertheless, because of the decay characteristics of ^{140}La, observed true to chance coincidence ratios ranged from 1 to 2 for sources of reasonable intensity. Coincidences with beta rays falling in the proper energy range were further analyzed according to beta-ray energy, W, with the aid of a multichannel pulse height analyzer. The correlation coefficient, $\epsilon(W)$, was then determined from the measured anisotropy coefficient, A(W). The results of this experiment are summarized below. The errors quoted are probable errors of the mean.

$W(m_0c^2)$	ϵ
4.21	0.127 ± 0.006
4.38	0.117 ± 0.012
4.40	0.124 ± 0.008
4.47	0.118 ± 0.011
4.57	0.119 ± 0.012
4.59	0.132 ± 0.007
4.67	0.119 ± 0.014
4.77	0.122 ± 0.020
0.78	0.127 ± 0.011
4.98	0.123 ± 0.027

These data were least squares fitted to the theoretical correlation coefficient expression using the general form of the shape correction factor which describes the outer group spectrum. Two sets of matrix element parameters result for each value of the parameter D of the shape factor. Of the two sets of matrix elements corresponding to the experimental value of D, one gives agreement with the experimental measurement of the beta-circularly polarized gamma correlation coefficient. This set is: u = +0.058 ± 0.020, x = −0.329 ± 0.037, Y = −1.219 ± 0.065. From the above parameters, the following nuclear matrix elements are obtained (the standard matrix element, η, is $\int B_{ij}$, and R is the nuclear radius in natural units):

$$|\eta| = (3.1 \pm 0.1) \times 10^{-15}$$
$$|\int B_{ij}/R| = (5.6 \pm 0.2) \times 10^{-2}$$
$$|\int \underline{ir}/R| = (2.2 + 0.3) \times 10^{-2}$$
$$|\int i\underline{\alpha} \times \underline{r}/R| = (3.2 \pm 0.3) \times 10^{-3}$$
$$|\int i\underline{\alpha}| = (5.0 \pm 0.7) \times 10^{-3}$$

These results are consistent with a cancellation effect explanation of the retarded nature of the outer group transition (log ft = 9.2). Neither of the selection rules referred to as "j or K forbiddenness" should apply. A second experiment was performed to measure the directional correlation coefficient associated with the 1.71 Mev inner beta group and the 0.487 Mev gamma ray. The result of this experiment is the average inner group correlation coefficient $\bar{\epsilon}_1 = 0.11 \pm 0.03$. This large value of $\bar{\epsilon}_1$ indicates a substantial contribution of the B_{ij} matrix element to the inner group transition, but lack of accurate data on the energy dependence of ϵ_1 and the inner group shape correction factor makes reliable assignment of nuclear matrix elements difficult. (Dissertation Abstr.)

26684 ELECTROMAGNETIC CROSS SECTIONS FOR ELECTRON AND NUCLEAR RESEARCH. H. W. Koch (National Bureau of Standards, Washington, D. C.). 21p. (CONF-354-6).

From Accelerator Conference, Boston, Nov. 1963.

Much of the extensive experimental data being generated by electron accelerators is difficult to interpret accurately because of the complexity of the electromagnetic cross section formalisms. The need for greater experimental and theoretical attention to these characteristic complexities is illustrated with the cross section analyses employed in recent experiments on the total nuclear cross sections for 10- to 70-Mev x rays. (auth)

26685 RESONANCE FLUORESCENCE IN Re^{187}. H. Langhoff (Franklin Inst., Swarthmore, Penna). 35p. (CONF-481-56)

From American Physical Society Annual Meeting, New York, Jan. 1964.

The excited states of ^{187}Re, populated in the decay of ^{187}W, were investigated by the resonance fluorescence method. Using the centrifuge technique, five resonantly scattered γ lines of 773-, 686-, 620-, 552-, and 479-kev energy, originating from the excitation of levels at 773, 686, and very probably 618 kev, were observed. The measured angular distributions of the γ radiations are in agreement with spin assignments and multipole orders deduced from studies of the radioactive decay of ^{187}W. Combining relative intensities with the observed cross sections for resonance scattering, the following mean lifetimes were computed. 773-kev level: $\tau = (2.5 \pm 0.3) \times 10^{-13}$ sec, 686-kev level: $\tau = 8.3 \pm 0.7) \times 10^{-12}$ sec, and 618-kev level: $\tau = (1.6 \pm 0.2) \times 10^{-11}$ sec. The results agree with the theoretical interpretation in terms of the Nilsson Model. The experiments give a lower limit of $\tau > 1.0 \times 10^{-12}$ sec for the lifetime of the 864-kev level, assuming spin $3/2$ or $5/2$. (auth)

Plasma Physics and Thermonuclear Processes

26686 (ARL-64-44(Pt.II)) STATISTICAL PLASMA THEORY II. PART II. THE KINETIC EQUATION FOR A PLASMA. G. Kalman (Paris. Université, Orsay. Ecole Normale Superieure. Faculte des Sciences). Spring 1963. Contract AF61(052)-613. 68p.

The derivation of the equilibrium correlation function in nonequilibrium plasma kinetics is discussed; the shielded effective Debye-potential is obtained. (R.E.U.)

26687 (ARL-64-49) BASIC RESEARCH ON GAS FLOWS THROUGH ELECTRIC ARCS–HOT GAS CONTAINMENT LIMITS. G. L. Cann, R. D. Buhler, R. L. Harder, and R. A. Moore (Electro-Optical Systems, Inc., Pasadena, Calif.). Mar. 1964. Contract AF33(657)-7940. 63p.

Extensive measurements in a "cascade"-type arc research apparatus were carried out with four gases (hydrogen, helium, ammonia, and argon), covering both the inlet region and the fully developed region of the coaxial flow discharge. The inlet (gas heater) region results for three gases were compared with the Stine-Watson first-order theory. For the size-pressure regime in which radiation can be neglected, the Stine-Watson relations with empirically adjusted constants gave a satisfactory semiempiircal description of all the inlet cases investigated. To estimate the ultimate technical limits of arc gas heater performance the well known approximate theories for the fully developed arc column (Parabola and Bessel Models) were extended to include radiation and, for the high current regime, the self-magnetic pressure gradient. Hot gas containment limits (highest radially averaged outlet enthalpy vs. pressure) were calculated for air, for a range of allowable wall heat loads (0.1 to 10 kw/cm^2). This resulted in a predicted "absolute" technical limit of continuous hot gas containment independent of size, within the pressure-size range of the optically thin gas approximation. The theoretical containment limit curves appropriate for a highly cooled thin metal wall (say 3 to 10 kw/cm^2) fall substantially above the empirical "state of the art" performance envelope for continuous arc tunnel heaters. Thus, it is concluded that: heat loads from mechanisms other than the simple hot gas containment (e.g., electrode heat loads, local secondary arcs, etc.) have so far limited the enthalpy-pressure values achieved; and gas heater performance substantially above the 1961 state of the art curve appears technically possible, with optimum designs. (auth)

26688 (ARL-64-60) A STATE-OF-THE-ART SURVEY OF SOME ASPECTS OF THE MECHANICS OF RAREFIED GASES AND PLASMAS. G. N. Patterson (Toronto. Univ. Inst. for Aerospace Studies). Apr. 1964. Contract AF33(616)-6990. 233p.

A survey of some aspects of the kinetic theory of rarefied gases (neutral molecules) and a brief introduction to the characteristics of ensembles of identical charged particles are presented. Consideration is given to the derivation and properties of the Boltzmann equation. The special form of the Boltzmann equation for free-molecule flow and the associated boundary conditions governing the distribution function are discussed. The latter involves the interaction of gas particles with surfaces; a subject that is still in an incomplete condition. The free-molecule flux of particles at an orifice and an element of surface of a body are considered, and results are applied to determine the aerodynamic properties of a sphere in a highly rarefied gas. The theory of free-molecule motion is extended to include multiple collisions with surfaces. The particular case of the flux of molecules through a tube was calculated with emphasis on radial distributions of mass transfer. The subject of near-free-molecule flow is introduced by a consideration of molecular beams and the effect of collisions on beam strength. A review of molecular beam systems from the point of view of design is included. An integral form for the Boltzmann relation, which facilitates an iterative method of solution, is shown to be a suitable basis for a study of the properties of near-free-molecule flow. However, this method requires the use of a kinetic model of the Boltzmann equation if the problem is to remain mathematically tractable. The required equations to be used for investigating the aerodynamics of isolated bodies

in near-free-molecule flow are then discussed. Various analytical solutions of the heat flow between parallel walls are given and the Monte Carlo method is summarized. The Boltzmann equation was reconsidered in detail for the more general case of an ensemble of identical charged particles. Relativistic effects are included. This brief account is terminated by a consideration of the distribution function for particles under the action of external forces. (auth)

26689 (BSD-TDR-64-34) WAVE GROWTH AND INSTABILITY IN PARTIALLY-IONIZED GASES. James E. McCune (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Apr. 1964. Contract AF04(694)-414. 16p. (AD-437128)

The possibility of the amplification of random or induced pressure fluctuations in slightly ionized plasmas in the presence of a magnetic field was discussed previously by Velikhov and others. Basically, this amplification can occur through a coupling between the waves and the background plasma due to the induced fluctuations in those plasma parameters that depend on the thermodynamic properties of the gas. In general, amplification requires the presence of a steady-state current, and some of the most interesting cases occur in the presence of a large Hall effect. A simplified method is presented for studying a large class of wave disturbances in partially ionized gases. Emphasis is placed first of all upon the physical description of these waves and their amplification or damping characteristics, with a view to aiding the intuitive understanding of their nature. It is found that, depending on the frequency and the initial (steady) state of the plasma as well as the orientation of the wave vector, waves can be amplified at a rate significantly greater than that indicated by Velikhov. (auth)

26690 (D1-82-0217) WINDOW PROBLEM IN A CYLINDRICAL GEOMETRY. Paul Rolland (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay and Boeing Scientific Research Labs., Seattle). Apr. 1963. 26p.

The problem of propagating an electromagnetic wave across a plasma cylinder containing a periodic potential along the axis is simplified by taking into account the collisions, which allows one to avoid a difficult Cauchy's problem. A first approximation, neglecting the variation of the field along the trajectories, gives the frequency range of the window, depending upon the number of trapped particles. By taking into account the influence of the radial variation of the field in a narrow tube on the electron trajectories, a better approximation is obtained, and the effect of the radial field can be seen. (auth)

26691 (IPPJ-23) MICROWAVE RADIATION AT CYCLOTRON HARMONICS IN A POSITIVE COLUMN. Shigetoshi Tanaka and Hiroshi Kubo (Nagoya, Japan. Univ. Inst. of Plasma Physics). Feb. 1964. 37p.

The microwave emission of electron cyclotron harmonics is measured on a positive column in arc discharge. The number of successive harmonics observed and their respective amplitudes increase with decreasing gas pressure. The highest harmonics number observed (N_{max}) is determined by the magnitude of the collision frequency between electron and neutral particles. It is shown that $N_{max} = 2$ in the high pressure discharge of neon ($p = 7.8$ torr) and $N_{max} = 15$ in the low pressure discharge of mercury vapor ($p = 2.6 \times 10^{-3}$ torr). As the gas pressure decreases, N_{max} measured on the plasma, when the whole discharge tube is immersed in the magnetic field, is larger than that, when a part of positive column is placed in the field. Peculiar resonant peaks are observed in the vicinity of the 2nd, 3rd and 4th harmonics. (auth)

26692 (NP-14011) SCATTERING OF LIGHT BY LIGHT IN PLASMAS. Research Report No. 302. D. F. DuBois and V. Gilinsky (Hughes Aircraft Co. Hughes Research Labs., Malibu, Calif.). Mar. 1964. 27p.

A quantum-mechanical calculation of the scattering rate of light by light in the polarizable medium of a plasma is carried out. It is shown that if the frequency ω_0 of the incident light is much greater than the electron plasma frequency ω_p, the ρA^2 term in the nonrelativistic Hamiltonian coupling the radiation to matter dominates the $j \cdot A$ interaction, provided the frequency shifts $\Delta\omega$ satisfy $\Delta\omega \ll \omega_0$. In this approximation the scattering amplitude is proportional to the Green's function for electron density fluctuations (which reduces to the electron density correlation function in the classical limit). This leads to an expression for the differential scattering rate which is formally exact to all orders in the interparticle interactions. The spectrum of the scattered light in this approximation has resonances at the collective modes of the plasma, if $\omega_0/c \ll k_D$. The total scattering rate is estimated in the collisionless approximation (RPA). Under the conditions of this calculation, rather high plasma densities and temperatures are required to obtain a detectable rate. (auth)

26693 (RISÖ-76) STUDIES OF PLANE, PERPENDICULAR MAGNETOGASDYNAMIC SHOCKS. C. T. Chang (Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø). Feb. 1964. 17p.

The general properties of a plane, perpendicular magnetogasdynamic shock are summarized and proved analytically on the assumption of the medium being a fully ionized perfect gas. A quantitative investigation of the state of the gas behind the shock as a function of the gasdynamic Mach number, M_1, and the pressure parameter, β_1, upstream of the shock is made. The result indicates, that for shocks moving at a speed in the range of interest pertaining to problems of controlled thermonuclear fusion, the magnetic field has little direct effect on the heating of the gas. It is then demonstrated that a strong magnetogasdynamic shock acts essentially like a snow plow, provided the gas concerned has many internal degrees of freedom. It is shown that there might exist shock waves in an initially cold, or collisionless, plasma (gas pressure, $p_1 = 0$). (auth)

26694 (AEC-tr-5589) PLASMA PHYSICS AND CONTROLLED NUCLEAR FUSION RESEARCH, CONFERENCE PROCEEDINGS, SALZBURG, 4-9 SEPTEMBER, 1961, [Soviet Papers]. Translated from Preprints of Russian Papers Presented at the Conference. 1046p.

Fifty-five papers are included. Separate abstracts were prepared for 15. Forty papers were previously abstracted for NSA; see abstracts 15: 13858; 16: 1154, 2604, 3792, 7218, 15725, 17209, 19874, 23221, 23222, 23229, 23230, 23234, 23237, 23239, 28301, 33942; 17: 987, 2401, 9695, 9733, 9738, 9745, 9747, 9750, 9751, 9756, 9761, 11880, 21184, 21186, 22758, 22759, 42092, 42093, 42094, 42095, 42096, 42108, 42109, 42112. (M.J.T.)

For abstracts of individual papers see: 26695, 26696, 26697, 26698, 26699, 26700, 26701, 26702, 26703, 26704, 26705, 26706, 26707, 26708, and 26709.

26695 (AEC-tr-5589(p.83-96)) EXPERIMENTAL INVESTIGATION OF PLASMA INSTABILITY IN A MAGNETIC MIRROR TRAP. M. S. Ioffe and E. E. Yushmanov. Translated from Russian.

The conductive theory for a mechanism of convective leakage of plasma from a trap was further experimentally confirmed. The plasma density pulsations in the wall re-

gion and the internal regions of the trap, the radial distribution of the plasma density, and the dependence of the plasma retention time on its density were studied. (M.J.T.)

26696 (AEC-tr-5589(p.438-62)) TURBULENT DISCHARGE IN A LONGITUDINAL MAGNETIC FIELD. B. B. Kadomtsev. Translated from Russian.

A model for a discharge in a moderate longitudinal field, where account is taken of only the local convective instability, is considered. It is shown that the convection resulting from this instability leads naturally to a force-free configuration of the magnetic field, in good agreement with that observed in experiment. The twisting of the current pinch, which occurs when the longitudinal current increases, is investigated. The mechanism of turbulent transport of energy is discussed qualitatively. (M.J.T.)

26697 (AEC-tr-5589(p.554-64)) SHOCK WAVES IN DILUTE PLASMA. A. A. Vedenov, E. P. Velikhov, and R. Z. Sagdeev. Translated from Russian.

Quasihydrodynamic equations, describing a plasma affected by competing effects of dispersion and of an increase in steepness of the leading front of a perturbation, are discussed. The structure of a sound wave in a dilute plasma is considered, using ionic sound as an example. It is assumed that ordinary dissipation due to collisions of particles is missing, but the reflection of ions from the leading front of the wave — collisionless dissipation — is taken into account. Instabilities at large and small amplitudes are discussed. (M.J.T.)

26698 (AEC-tr-5589(p.565-84)) COMPRESSION OF A PLASMA BY A RAPIDLY INCREASING MAGNETIC FIELD. G. N. Aretov, V. I. Vasil'ev, V. S. Komel'kov, M. I. Pergament, and S. S. Tserevitinov. Translated from Russian.

The behavior of a plasma in traps at moderate fields was studied. It was found that, in spite of the drift of particles through the magnetic slot and the mirror, compression, heating, and confinement of injected plasma takes place during the first quarter of the half cycle in rapidly-growing opposing magnetic fields. A high degree of gas ionization is reached, as is evidenced by the fact that the particles drift only through the annular magnetic slot and by the drop in radiation of the D_α and D_β lines with simultaneous increase in the continuum. (M.J.T.)

26699 (AEC-tr-5589(p.596-611)) PROPAGATION OF ELECTROMAGNETIC WAVES IN A PLASMA ALONG A MAGNETIC FIELD. I. A. Kovan, B. I. Patrushev, V. D. Rusanov, V. P. Smirnov, and D. A. Frank-Kamenetskii. Translated from Russian.

The excitation of some simple types of axially symmetric waves in a plasma waveguide was experimentally investigated, thus working toward the verification of the premises of the cold-plasma approximation. Alfven torsion waves and oblique magnetic sound waves were considered. It was also experimentally shown that it is possible to excite waves without axial symmetry. (M.J.T.)

26700 (AEC-tr-5589(p.612-25)) THEORY OF MAGNETOACOUSTIC RESONANCE IN A PLASMA. D. A. Frank-Kamenetskii. Translated from Russian.

Buildup, absorption resonances, and normalized electron density are defined. Resonant frequencies of cold plasma are described. Magnetoacoustic resonance and plasma gyrotropic properties are considered. The penetration of the field in the plasma is discussed. Possible applications of magnetic-sound resonance are suggested. (M.J.T.)

26701 (AEC-tr-5589(p.626-36)) MEASUREMENT OF THE ENERGY OF IONS IN A TRAP WITH MAGNETIC MIRRORS. Yu. V. Gott and V. G. Tel'kovskii. Translated from Russian.

Results of measurements of ion energies in a magnetic trap with the magnetron method of acceleration are reported. The differential spectrum of ions in the apparatus was obtained. (M.J.T.)

26702 (AEC-tr-5589(p.637-77)) MOTION OF INDIVIDUAL CHARGED PARTICLES IN A TRAP WITH MAGNETIC MIRRORS OF THE OGRA TYPE. V. M. Balebanov, V. B. Glasko, V. V. Kutnetsov, A. G. Sveshnikov, N. N. Semashko, and A. N. Tikhonov. Translated from Russian.

An attempt is made to clarify the conditions for a particle leaving the trap and the direction of the particle azimuthal drift in the trap magnetic field, for the OGRA. Computer integration of the exact equations of motion showed the deductions of the drift theory to be inaccurate. Using calculations and simulation with electrons, it was demonstrated that a negative drift can be obtained for particles injected into the trap in a limited angle interval. An optimal magnetic field, increasing in all directions away from the center of the trap, was constructed. This condition usually prevents flute instability in a plasma with equiprobable distribution of the particle-velocity vector directions. (M.J.T.)

26703 (AEC-tr-5589(p.678-88)) IONIC-SOUND EXCITATION IN THE POSITIVE COLUMN OF A GAS DISCHARGE. A. V. Nedospasov. Translated from Russian.

A confirmation of the excitation of ionic-sound waves in a stabilized gas-discharge plasma was sought. Both theoretical calculations and experiment show that the buildup of low-frequency noise begins even in a weakly ionized plasma at pressures on the order of 10^{-1} mm Hg and current densities on the order of 10^{-2} amp/cm^2. The oscillation amplitude increases upon penetrating deeper into the instability region, by changing the pressure or by increasing the current strength. (M.J.T.)

26704 (AEC-tr-5589(p.689-708)) INVESTIGATION OF VARIOUS STATES OF COMPRESSION OF A PLASMA LOOP IN THE Zh-O INSTALLATION. S. M. Osovets, Yu. F. Nasedkin, E. I. Pavlov, and N. I. Shchedrin. Translated from Russian.

The results of further investigations on a plasma loop in a transverse magnetic field are reported. Principal attention is paid to the compressed state and the requirements which must be satisfied in order that the compression process be realized under conditions sufficiently close to optimal. The focusing conditions for both coordinates of the collapsing loop were determined. (M.J.T.)

26705 (AEC-tr-5589(p.758-66)) INVESTIGATION OF CONDITIONS OF CHARGE DEVELOPMENT IN A SPATIALLY-PERIODIC MAGNETIC FIELD. R. A. Demirkhanov, T. I. Gutkin, M. A. Stotland, A. G. Kirov, S. M. Temchin, Yu. V. Kursanov, and T. R. Soldatenkov. Translated from Russian.

It is found that the spatially periodic configuration of a closed-geometry magnetic field makes it possible to exclude the toroidal drift effect. The development of the discharge excited by an induced electric field occurs in the near axial region, away from the walls of the discharge chamber. It was established experimentally that a plasma pinch remains macroscopically stable during the entire pulse of the induced current. (auth)

26706 (AEC-tr-5589(p.767-72)) ON THE CHARACTER OF THE INSTABILITY ARISING FROM THE INTERACTION OF AN ELECTRON BEAM WITH A PLASMA. R. A. Demirkhanov, A. K. Gervorkov, and A. F. Popov. Translated from Russian.

Problems in the observed oscillations in interactions between beams of charged particles and a plasma are studied. In particular, the form of the instability produced the coefficients of application, and nonlinear effects arising during sufficiently large amplitudes of the excited oscillations are investigated experimentally. Distributions of the intensity of the received oscillations along the beam were obtained. (M.J.T.)

26707 (AEC-tr-5589(p.831-60)) CONTRIBUTION TO THE THEORY OF FLUCTUATIONS IN A PLASMA. V. P. Silin. Translated from Russian.

The question of fluctuations in a plasma which is not in thermodynamic equilibrium is considered. Fluctuations of the electromagnetic field in the plasma are studied. Then the correlation function of a pair of plasma particles is considered, taking into account only the Coulomb interaction between particles. (M.J.T.)

26708 (AEC-tr-5589(p.861-8)) SPECTROSCOPIC MEASUREMENT OF ION TEMPERATURE WITH THE "TOKOMAK" APPARATUS. V. G. Koloshnikov and S. L. Mandel'shtam. Translated from Russian.

The ion temperature of a hot plasma and its time variation during the discharge were measured on the basis of the Doppler broadening of the spectral lines radiated by the corresponding ions. A photoelectric procedure for recording the contours of the spectral lines was developed. The high-resolution spectral instrument used was a Fabry-Perot etalon. (M.J.T.)

26709 (AEC-tr-5589(p.869-87)) SYSTEM FOR THE CONFINEMENT OF A PLASMA BY THE FIELD OF A TRAVELING WAVE. V. G. Andreev, I. A. Borzunov, E. L. Burshtein, et al. Translated from Russian.

Principles for plasma confinement using a high-frequency magnetic field are explained. High-frequency currents in parallel wires, shifted in phase, produce a traveling wave. Magnetic fields coupled with the currents increase the magnetic pressure on the plasma approaching the wires. Thus plasma equilibrium is ensured. The Delta installations, operating on this principle, and measurements carried out at them are described. (M.J.T.)

26710 (AEC-tr-6227/1(p.15-24)) BROADENING AND SHIFT OF THE Al(III) SPECTRAL LINES IN STRONGLY IONIZED PLASMA. M. A. Mazing, M. D. Marinković, and N. A. Vrublevskaia. Translated from Bull. Boris Kidrich Inst. Nucl. Sci., 15: No. 1, 15-24(1964).

The widths and wavelengths of the Al III spectral lines excited in five different sources with different electron concentrations were measured. The shift of the lines remained exactly proportional to the line width in a wide range of electron concentrations. The true wavelengths of the Al III lines, corresponding to zero electron concentration, were obtained by extrapolation. The wavelengths of some lines obtained in this way differed from the values given in tables. The results are discussed. (auth)

26711 (FTD-TT-64-400) PENETRATION OF PLASMA FROM A SOURCE WITH ELECTRON OSCILLATIONS TO AN EVACUATED REGION WITH A MAGNETIC FIELD. M. D. Gabovich, L. I. Romanyuk, et al. Translated from Zh. Tekhn. Fiz., 34: 488-95(1964). 16p.

The potential relief in a plasma emitted from a source with electron oscillations to an evacuated region located in a magnetic field was experimentally determined. The formation of fast ions and electrons emitted from such a source is examined. (auth)

26712 KINETIC THEORY OF A WEAKLY UNSTABLE PLASMA. E. Frieman and P. Rutherford (Princeton Univ., N. J.). Ann. Phys. (N. Y.), 28: 134-77(June 5, 1964).

The evolution of a weakly unstable, spatially uniform classical plasma is studied. Two methods are used. In the first method the nonlinear Vlasov equation is solved by a rigorous expansion technique with two small parameters γ_k/ω_k and $E_k^2/n\kappa T$, where γ_k and ω_k are the growth rate and frequency of the unstable modes with wave vector k, and E_k is a typical amplitude of the electric field in the unstable modes. This leads to a quasi-linear theory in which mode coupling effects are important; these are fully discussed. In the second method the problem is considered on the basis of a kinetic theory developed from the BBGKY hierarchy of equations. In this case a further expansion parameter is $1/n\lambda_D^3$ where n is the number density and λ_D the Debye length. It is shown that the Balescu-Lenard kinetic theory may be modified to include instabilities provided the field fluctuations in the unstable modes are correctly treated by a nonlinear theory which again includes mode-coupling effects. The two methods are compared and discussed. (auth)

26713 TRANSVERSE WAVES PROPAGATING ALONG AN APPLIED MAGNETIC FIELD IN A PLASMA. R. E. Burgess and J. G. Cook (Univ. of British Columbia, Vancouver). Can. J. Phys., 42: 906-17(May 1964).

Transverse waves propagating along an applied magnetic field are studied, with special attention to the role of the magnetic field in determining the behavior of the wave. No restrictions are placed on the hole (or ion) mass, and the electron and hole densities may differ. The behavior of the magnetic-field-dominated waves is studied, and it is shown that it is profitable to extend the concept of an Alfvén wave to include those waves for which essentially B_0 instead of B_0^2 appears in the dispersion equation. Both intrinsic and extrinsic cases are studied. The dispersion equation approach is compared with the equation of motion and Ohm's law approach used by Watanabe for a study of Alfvén waves; Watanabe's starting equations are generalized to make possible a study of Alfvén waves in solid-state plasmas using Watanabe's approach. (auth)

26714 THE MAGNETOHYDRODYNAMIC WAVES IN A FLUID IN UNIFORM ROTATION. John Carstoiu (Science for Industry, Inc., Brookline, Mass.). Compt. Rend., 258: 2745-7(Mar. 9, 1964).

The magnetohydrodynamic waves in a uniformly rotating, viscous, perfectly conducting fluid were studied. The emphasis was on the modes of propagation of the eddy, particularly those of its longitudinal component. (J.S.R.)

26715 STUDY OF PREDISCHARGES UNDER VERY LOW PRESSURES. Jean Mazeau and Max Goldman (Laboratoire de Synthese Atomique et d'Optique Protonique, Ivry, France). Compt. Rend., 258: 2774-7(Mar. 9, 1964). (In French)

The association of optical observations and electric measurements have permitted the delineation of different regimes of predischarges during electrode conditioning and, thus, the determination of the conditions under which previously reported results were obtained. It was observed that a continuous current, often considered as the resultant of a field emission, appears only if there has been, at the beginning, a surface alteration of the electrodes. Its appearance is accompanied by the formation of luminous "spots" on the anode and on the two electrodes. It was noticed that the disruptive channel is often formed apart from these "spots." (tr-auth)

26716 ROLE OF DISSOCIATION IN IONIZATION PHENOMENA OF HYDROGEN IN A PULSED DISCHARGE. Claude Breton. Compt. Rend., 258: 3648-51(Apr. 6, 1964). (In French)

The importance of the dissociation of hydrogen molecules in a pulsed discharge during transitory phenomena leading to a perfectly confined and supposedly homogeneous plasma of protons and electrons was studied theoretically. The results were compared with those obtained by assuming the hydrogen to be completely dissociated at the beginning of the process. The ionization velocities obtained in these two cases are significantly different. (tr-auth)

26717 THE DISTRIBUTION OF ELECTRIC AND MAGNETIC FIELDS IN A ROTATING PLASMA AT THERMODYNAMIC EQUILIBRIUM. M. V. Samokhin. Dokl. Akad. Nauk SSSR, 155: 72-4(Mar. 1, 1964). (In Russian)

The movement of a neutral gas in a state of thermodynamic equilibrium consists of translational motion and rotation about a fixed axis. If the gas is made up of charged particles, charge separation takes place due to the rotation, and to the electric and magnetic fields that are created. Since the total force acting on each type of charged particle has a potential, the basic equations can be written in the following form: $n = n_0 \exp(-\psi/\theta)$, and $qE + m[v_\theta, \vec{\omega} + \vec{\Omega}] = -\partial\phi/\partial r$. Here n_0 is the particle density at $\psi = 0$, and ψ is the potential; q and m are the charge and mass of the particle; $\vec{\Omega}$ is the rotation frequency, and $\vec{\omega}$ is the Larmor frequency; and v_θ is the average component velocity with $v_\theta = v' + [\vec{\Omega}, r]$. Here v' and $\vec{\Omega}$ are constants. If the potential is small compared to the temperature, $\exp(-\psi/\theta) \simeq 1 - \psi/\theta$, and the equations become linear. A set of equations was written for a plasma consisting of electrons and singly-charged ions rotating in a cylinder of radius ρ_0. It was found that the charge distribution at the center of the cylinder is determined by the rotation frequency and the radius of the cylinder. The reduced magnetic field, the reduced electrical field, the charge, the current, electron potential, and ion potential were plotted as a function of $r = \rho/\rho_0$. Analytical expressions are given for maximum values of these quantities. (TTT)

26718 MAGNETOHYDRODYNAMICS. W. B. Thompson (Oxford Univ.). Endeavour, 23: 73-80(May 1964).

The theory of channel flow and magnetic confinement in magnetohydrodynamics is discussed. (C.E.S.)

26719 POWER PRODUCTION THROUGH FUSION AND GENERAL PROPERTIES OF PLASMAS. M. Bayet. Genie Chim., 90: 12-16(July 1963).

After a cursory examination of different potential sources of energy (solar radiation, nuclear fission, natural radioactivity, and organic or mineral chemical reactions), some intercomparisons subsequently dwelling on the general properties of plasmas are made, bearing in mind possible use of the energy generated by fusion. (Sum. Articles French Tech. Press, No. 6, 1963)

26720 DISTRIBUTION OF PARTIAL PRESSURE OF NEGATIVE IONS IN A POSITIVE LOW PRESSURE DISCHARGE COLUMN. A. M. Rezikyan, G. A. Galechyan, and V. V. Galechyan (Inst. of Radiophysics and Electronics, Academy of Sciences, Armenian SSR). Izv. Akad. Nauk Arm. SSR, Ser. Fiz. Mat. Nauk, 16: 117-24(1963). (In Russian)

A system of equations was developed for radial distributions of partial pressures of negative ions in a positive column of gas capable of forming negative ions. The negative ions are produced by processes in which neutral molecules capture free electrons, neutral molecules, dissociates into positive and negative ions, or positive ions capture two electrons. The mechanism of negative ion formation by electron capture takes place by either radiative or triple-collision capture. In the latter case an electron, ion, or neutral molecule may act as the third particle. The equations consider the length of the free path for electrons, positive or negative ions, and neutral molecules. The calculations are limited to a discharge in a plane with a distance (d) between the two walls. Such a case is identical to a cylinder with radius (r), where $d/r = \pi/2 \times 2.409$. In the absence of a magnetic field the partial pressures of electrons, ions, and neutral gas are distributed in such a manner that their total is constant at any arbitrary point. The obtained equations include electron pressure as a function of temperature at T/t = 30, and coincide with Steinbeck data. (R.V.J.)

26721 ON GYRORESONANCE RADIATION AND ABSORPTION IN AN EQUILIBRIUM MAGNETO-ACTIVE PLASMA. V. V. Zheleznyakov (Gor'kii State Univ., USSR). Izv. Vysshikh Uchebn. Zavedenii, Radiofiz., 7: 67-82(1964). (In Russian)

The radiation of a weakly relativistic electron moving along a helix in a magneto-active plasma is considered. The absorption coefficient of electromagnetic waves in an equilibrium plasma at frequencies $\omega \simeq s\omega_H (s = 1, 2, 3, \ldots;$ ω_H = the electron gyrofrequency is found using Kirchoffs' law; the absorption is connected with the synchrotron radiation of weakly relativistic plasma electrons. The expressions obtained were compared with the corresponding absorption coefficients; the latter was found by means of the kinetic equation method with a self-consistent field. (auth)

26722 ON THE PASSAGE OF ION BEAMS THROUGH PLASMA. V. B. Krasovitskii and K. N. Stepanov (Inst. of Physics and Tech., Academy of Sciences, Ukranian SSR). Izv. Vysshikh Uchebn. Zavedenii, Radiofiz., 7: 83-93(1964). (In Russian)

The excitation of electromagnetic waves in plasma by a low density ion beam with wide thermal velocity dispersion is investigated in the frequency band $\omega_H \gg \omega \gg \omega_i$ (where ω_H is the electron gyrofrequency and ω_i is that of ions). The ion beam is assumed to be injected into the plasma at a large angle to the external magnetic field H_0, so that $v_{0\parallel} \sim v_{0\perp} \gg v_T$ ($v_{0\parallel}$ and $v_{0\perp}$ are the components of the beam velocity parallel and perpendicular to H_0 and v_T is the mean thermal velocity of the beam particles). The increment is shown to exceed considerably that in the case of beam parallel to H_0. (auth)

26723 TO THE THEORY OF WAVE INTERACTION IN PLASMA. I. A. Daneliya and N. L. Tsintsadze. Izv. Vysshikh Uchebn. Zavedenii, Radiofiz., 7: 94-100(1964). (In Russian)

The excitation of electromagnetic and longitudinal waves is considered as a result of nonlinear interactions of longitudinal oscillations. Electromagnetic radiation is shown to arise in a cold plasma only in the case where the direction of wave propagation does not coincide with the axis of anisotropy, the latter being the direction of particle motion. Expressions are obtained for average transferred particle flux. (auth)

26724 ON THE FLUCTUATIONS IN PERIODICALLY NONSTATIONARY SYSTEMS. V. N. Lugovoi (Lebedev Inst. of Physics, Moscow). Izv. Vysshikh Uchebn. Zavedenii, Radiofiz., 7: 113-23(1964). (In Russian)

The fluctuation-dissipation theorem is generalized for the classical, periodically nonstationary, equilibrium systems. A relation is found between the spectral characteristics of discrete fluctuating parameters and the impedance matrix of the systems. The results were generalized for continuous systems and were applied to the

electromagnetic fluctuations in periodically nonstationary equilibrium media. As an example, electromagnetic fluctuations have been considered in an ideal resonator filled with a rarefied, strongly magnetized electron plasma, the external magnetic field varying periodically. (auth)

26725 TWO-DIMENSIONAL ELECTROMAGNETIC FIELDS GUIDED BY PLASMA LAYERS. [PART] I. I. G. Kondrat'ev and M. A. Miller (Gor'kii State Univ., USSR). Izv. Vysshikh Uchebn. Zavedenii, Radiofiz., 7: 124-34 (1964). (In Russian)

Two-dimensional electromagnetic waves guided by a stratified isotropic plasma are considered. The reflection coefficients of an electromagnetic wave incident upon a single plasma layer are near to unity: (a) for a sufficiently dense plasma layer, (b) for arbitrary grazing incidence and density, and (c) for TM modes incident upon the so-called zero layer ($\epsilon = 0$). The case of complex incidence angles can be included here. All these possibilities may be used in waveguide systems with plasma walls. Radiation losses, the effect of collisions and spatial dispersion, and the effect of the focusing magnetic fields are discussed for these systems. (auth)

26726 ON FIELD STRUCTURE WITHIN A PLASMA LAYER OF ZERO PERMEABILITY. I. G. Kondrat'ev and M. A. Miller (Gor'kii State Univ., USSR). Izv. Vysshikh Uchebn. Zavedenii, Radiofiz., 7: 176-9(1964). (In Russian)

The calculation of spatial dispersion does not remove the effect of complete reflection, but only displaces the resonant value ϵ from zero. The zero layer ($\epsilon = 0$) remains slightly transparent for transverse magnetic waves. Energy leakage through the layer leads to calculation of the usual values of the Poynting vector; thus both the electric and magnetic fields within the layer are nonzero. Transformation to a zero, spatially nondispersive layer is possible only for a predetermined order of rotation of the parameters into zero. This requirement is analogous to that in the case of normally incident waves. (M.J.T.)

26727 ON THE RADIATION OF LONGITUDINAL WAVES IN MEDIA WITH WEAK SPATIAL DISPERSION. M. L. Levin. Izv. Vysshikh Uchebn. Zavedenii, Radiofiz., 7: 180-1(1964). (In Russian)

Two approaches have been used in electromagnetic-wave propagation in a medium with weak spatial dispersion. Either the permeability dielectric tensor $\hat{\epsilon}(\omega,k)$ or the inverse tensor $\hat{\epsilon}^{-1}(\omega,k)$ has been analyzed in powers of the wave vector $\underline{k}$, cut off at quadratic terms. It is shown that, upon consideration of the longitudinal field (plasma waves) of sources found in a very dispersive medium, the second analysis seems more correct. (M.J.T.)

26728 ON THE BOUNDARY CONDITIONS AT AN INSULATING WALL FOR HYDROMAGNETIC WAVES IN A CYLINDRICAL PLASMA. L. C. Woods (Oxford Univ.). J. Fluid Mech., 18: 401-8(Mar. 1964).

The order of the dispersion relation for the propagation of hydromagnetic waves along a magnetized cylindrical plasma falls by unity when the plasma resistivity, σ^{-1}, tends to zero. A consequence of this is that the two boundary conditions necessary on an insulating wall are reduced to a single condition, a reduction brought about by the development of a current sheet. If the ratio, $\Omega \equiv \omega/\omega_{ci}$, of the wave frequency to the ion cyclotron frequency is also assumed to be vanishingly small, then the nature of the single boundary condition to be adopted in the limit $\sigma^{-1} \to 0$ depends, for the slow hydromagnetic wave, on the limiting value of $\sigma^{1/4}\Omega^2$. Similarly, if $\Omega \gg 1$, and the fast hydromagnetic wave is being considered, then the relevant boundary condition is found to depend on the limiting value of $\Omega\sigma^{-1/2}$. The resistive waves that are found to accompany the fast and slow waves, in order to satisfy the boundary conditions for small but finite values of σ^{-1}, are studied in some detail and their contribution to the wave damping is determined. (auth)

26729 DETAILED SOLUTIONS OF PERIODIC WAVES FOR NON-LINEAR STATIONARY PLASMA WAVES WITH SMALL AMPLITUDE. Y. Ozawa (Hokkaido Univ., Sapporo), I. Kaji, and M. Kito. J. Nucl. Energy, Pt. C, 6: 227-36 (May-June 1964).

On the basis of Vlasov's and Poisson's equations, one-dimensional stationary electron plasma waves are exactly treated in the phase space (x,v) instead of in the energy space $E = \frac{1}{2}mv^2 - e\phi(x)$, by considering both the effects of trapped and untrapped electrons in the potential trough. An existence condition of the waves, which are periodic in space, is obtained. When the amplitude of the waves is small, the existence conditions for the periodic solutions are tabulated. The solutions are classified into the unharmonic or harmonic waves. For the former waves, there exist jump discontinuities between distribution functions both for untrapped and trapped electrons. For the latter, on the contrary, these discontinuities disappear and a continuous characteristic of the velocity distribution function is produced. The linear theory of van Kampen is included in the harmonic solutions. It is clarified that the term appearing in his theory is directly related to the number of trapped electrons in the potential troughs of the plasma waves, and this comes from the coefficient of the second-order term in an expansion of the electron density with respect to the amplitude of potential fluctuations in the plasma. The detailed aspects both for amplitude and distortion of the stationary plasma waves are represented in the unit circle. (auth)

26730 THE MICROWAVE EMISSIVITY OF TURBULENT PLASMA. D. J. H. Wort (United Kingdom Atomic Energy Authority, Abingdon, Berks, Eng.). J. Nucl. Energy, Pt. C, 6: 237-50(May-June 1964). (CLM-P34)

The zeta plasma is believed to contain field-aligned irregularities in density, loosely called turbulence. Such irregularities cause scattering of a microwave beam traversing the plasma, and will also affect the emission of thermal microwave noise. To calculate the effect on the emissivity, a naive model of the turbulence is taken in which the individual turbulence elements are considered to be parallel cylinders, the density profile within the cylinders being parabolic. A ray theory treatment of the emissivity of a cylinder is combined with a statistical treatment of the radiation mean free path, and the time-averaged emissivity of the plasma is calculated in terms of element size, spacing and central density, the plasma electron temperature and the size and reflectivity of the containing vessel. It is found that the turbulence can increase or decrease the emissivity several-fold according to the values of the various parameters and that the range of variation is sufficient to encompass the discrepancies between observed and calculated emissivities previously reported. (auth)

26731 SPATIAL DISPERSION AND ABSORPTION OF WAVES IN BOUNDED LOW-DENSITY PLASMA. P. Weissglas (Uppsala Univ.). J. Nucl. Energy, Pt. C, 6: 251-65 (May-June 1964).

Reflection, absorption, and emission of electromagnetic waves by a hot inhomogeneous plasma cylinder are studied. It is shown that the inhomogeneity has a very large effect on the condition for the appearance of reflection maxima,

causing these maxima to be much more widely spaced on a frequency scale than those in a homogeneous plasma. An attempt is made to explain observed spontaneous emission of radiation in the microwave region. Landau damping in inhomogeneous plasma is studied by means of a finite one-dimensional model. It is found that due to the coupling of the sinusoidal standing waves even low-order modes may suffer considerable damping in strong contrast to the case when the plasma is homogeneous. (auth)

26732 ELECTROSTATIC INSTABILITIES IN CURRENT-CARRYING COUNTERSTREAMING PLASMAS. T. E. Stringer (United Kingdom Atomic Energy Authority, Abingdon, Berks, Eng.). J. Nucl. Energy, Pt. C, 6: 267-79(May-June 1964).

The maximum growth rate of longitudinal plasma waves of small amplitude in a current-carrying plasma and in two counterstreaming plasmas is evaluated as a function of the drift velocity and the electron-to-ion temperature ratio. A non-linear dispersion equation is derived from the collisionless Boltzmann equation, using an iteration procedure, and is used to predict the upper limit to the instability in a current-carrying plasma. (auth)

26733 EXCITATION OF m = 0 INSTABILITIES IN A Z-PINCH DISCHARGE. F. L. Curzon, R. T. Hodgson, and R. J. Churchill (Univ. of British Columbia, Vancouver, Can.). J. Nucl. Energy, Pt. C, 6: 281-7(May-June 1964).

Single m = 0 instability modes were excited in the normally stable initial stage of an argon Z-pinch discharge by means of a set of equally spaced glass rings. High-speed framing camera photographs show that the instabilities develop approximately in accordance with the Rayleigh-Taylor theory. No axial drift of the instabilities is observed but the new technique of studying instabilities reveals that the acceleration of the discharge boundary changes appreciably three or four times during the course of the first stage of the discharge. (auth)

26734 ON THE STRESS TENSOR OF A PARTIALLY IONIZED GAS IN THE PRESENCE OF ELECTRIC AND MAGNETIC FIELDS. H. A. Hassan (Univ. of North Carolina, Raleigh). J. Nucl. Energy, Pt. C, 6: 289-93(May-June 1964).

Explicit expressions for the stress tensors of the constituents of a partially ionized gas and the overall stress tensor are presented. The derivation is based on Burgers' transfer equations and takes into consideration the presence of electric and magnetic fields. The results include, as a limiting case, the results of Burgers and Herdan and Liley for the fully ionized case. (auth)

26735 MAGNETIC-PROBE STUDIES OF AZIMUTHAL PINCH DISCHARGES IN HYDROGEN. M. R. Barrault, J. Labat, W. Ohlendorf, and A. N. Prasad (Univ. of Liverpool). J. Nucl. Energy, Pt. C, 6: 295-8(May-June 1964).

Magnetic probe measurements in a hydrogen azimuthal pinch discharge are reported. The locus of the outer-luminous plasma boundary, the outer-current density maximum, and that of the plasma in the snowplough approximation are shown. The change of magnetic flux was evaluated and used to determine the plasma resistivity. An equivalent electron temperature was obtained. (C.E.S.)

26736 NONLINEAR STATIONARY PLASMA WAVES. Masafumi Kito (Electrotechnical Lab., Tokyo) and Ikuo Kaji. J. Phys. Soc. Japan, 19: 555-9(Apr. 1964).

Nonlinear stationary electron plasma waves are investigated in one-dimensional case. The effects of electrons which are and are not trapped in potential troughs are both considered. A condition for the existence of plasma waves which are periodic in space is obtained in the case that the amplitudes are sufficiently small. The waves are classified into harmonic and unharmonic waves. It is shown that while the electron distribution function for the former is continuous, that for the latter has a discontinuity. A dispersion relation for the harmonic waves which was obtained by Van Kampen is rederived. (auth)

26737 EFFECTS OF CLOSE COLLISIONS ON ION OSCILLATIONS IN A PLASMA. Noriyoshi Sato and Yoshisuke Hatta (Tohoku Univ., Sendai). J. Phys. Soc. Japan, 19: 566-72(Apr. 1964).

The effects of close collisions on ion oscillations in a fully ionized plasma are examined. The damping rate due to the ion-ion collisions is derived from the Boltzmann-Vlasov equation which includes the collision terms used by Bhatnagar. The so-called "two-stream instability" in a plasma is considered in some detail taking into account the effects of the collisions. As the collision frequencies become large compared with the frequencies of oscillations, the results tend to those of the two-fluid model; and the ion oscillations are stable as long as the relative drift velocity between electrons and ions is not larger than the thermal velocities of these particles. (auth)

26738 MARGINAL STABILITY CONDITION FOR STATIONARY NON-DISSIPATIVE MOTIONS. G. Laval, R. Pellat, M. Cotsaftis, and M. Trocheris (Euratom-CEA, Fontenay-aux-Roses, France). Nucl. Fusion, 4: 25-9(Mar. 1964).

A method is proposed for examining the linear stability of the stationary states of a Lagrangian system by considering the marginally stable modes. A necessary and sufficient condition for marginal stability is derived. Perturbation theory is used to compute the change in frequency of a marginally stable mode as a result of a small change in the system. It is then possible to determine the changes of stability of a system depending continuously on one parameter. Stability can be examined by considering only normal modes for real values of the frequency. The method reduces to Poincaré's method of forms of bifurcation in the particular case of equilibria, for which the square of the frequency of a normal mode is always real. (auth)

26739 A SURVEY OF EXPERIMENTS ON ION CYCLOTRON RESONANCE IN PLASMAS. William M. Hooke and Milton A. Rothman (Princeton Univ., N. J.). Nucl. Fusion, 4: 33-47(Mar. 1964).

A review is presented of all published experiments concerning the production, propagation, and utilization of the slow, or torsional ion-cyclotron plasma wave at frequencies near the ion cyclotron frequency. A brief summary of the theory of propagation and absorption of ion cyclotron waves is followed by a survey of the experimental work in this field. The various methods of wave generation are described, with major emphasis on the use of induction coils and radial electric fields. The experimental verification of the dispersion relation is discussed. The measurement of power in the wave, the damping of the wave by ion cyclotron absorption, and the heating of plasma by this means are described in detail. 44 references. (auth)

26740 LAMINAR THEORY OF SHOCK WAVES IN PLASMA IN THE ABSENCE OF COLLISIONS. R. V. Polovin (Physical-Technical Inst., Academy of Sciences, Kharkov, USSR). Nucl. Fusion, 4: 52(Mar. 1964).

A survey is presented of theoretical work performed on the structure of a shock wave in plasma without collisions. Under these conditions the motion of the medium is laminar. The magnetic field is taken to be non-zero. For the

case when the magnetic field equals zero, the formulation of the problem for the structure of a shock wave in the absence of collisions is incorrect. The thermal energy behind the shock wave is concentrated in ion-acoustic waves appearing at the front of the shock wave due to reversed Landau damping. Nonlinear interaction of the waves leads to disordered (thermal) oscillations. Nonlinear waves in cold plasma that move at an acute or right angle with the magnetic field, shock waves for rare collisions, unsteady shock waves in a cold plasma without collisions, and dissipation resulting from instabilities are discussed. Plasma heating was investigated in an isolated wave for the case when the square of the thermal velocity can be neglected. The case of arbitrary temperature has shown that in a kinetic study the structure of the shock wave is of an ergodic nature. This means that infinitesimal fluctuations of magnetohydrodynamic values in front of the shock wave increase exponentially at first and then pulsate randomly without returning to the initial state. The effective heating is obtained by averaging over these pulsations. It is shown that this process leads to an increase of the rate of thermonuclear reactions. The relaxation length is equal to the Debye radius. The difference between electron and ion temperatures and anisotropy of the pressure tensor behind the shock wave are discussed. 71 references. (auth)

26741 MOVEMENT OF A HELICAL PLASMA SEGMENT IN A MAGNETIC CONFIGURATION AT A ZERO-FIELD POINT. G. Laval and R. Pellat (Euratom-CEA, Fontenay-aux-Roses, France). Nucl. Fusion, 4: 52(Mar. 1964).

Using a simplified model, the motion of a plasmoid injected axially into a magnetic configuration of revolution at a zero-field point of the "mono-cusp" type is analyzed. It is found that with no initial trapped field in the plasmoid traversal of the cusp is possible only if the injection speed of the plasmoid is greater than the Alfvén-equivalent speed. On the other hand, with an initial trapped field the cusp operates as an accelerator. (auth)

26742 EXPERIMENTAL RESULTS ON PLASMA ACCELERATION BY GRADIENTS OF STATIC MAGNETIC AND ELECTROMAGNETIC FIELDS. R. Bardet, T. Consoli, and R. Geller (Centre d'Etudes Nucleaires, Saclay, France). Nucl. Fusion, 4: 52(Mar. 1964).

A pulsed plasma injector that provides a plasma of high purity is described. The plasma is created by a pulsed PIG discharge and is accelerated by the combined action of a u-h-f field provided by a cavity operating in the TE_{111} mode and a gradient of a static magnetic field. The results of flight-time and energy measurements on the accelerated particles are included, and the diagnostic apparatus are described. (D.C.W.)

26743 ELECTRON OPTICAL RECORDING OF THE RADIATION FROM A FAINTLY LUMINOUS PULSED PLASMA. M. M. Butslov, A. G. Plakhov, V. V. Shapkin, and N. M. Yashin. Opt. Spectry. (USSR) (English Trans.), 16: 178-81(Feb. 1964).

An electron optical method is described for recording the radiation from a faintly luminous pulsed plasma. It is shown that it is possible, using a five-stage image converter, to scan, with good time resolution, spectral regions, spectral line contours and a spatial-temporal distribution of plasma radiation in monochromatic light during a single pulse. The proposed method was tried out with a plasma apparatus using helical fields. Photographs obtained in working with helium plasma are presented. (auth)

26744 EQUILIBRIUM AND STABILITY OF PLASMA IN ARBITRARY MIRROR FIELDS. J. B. Taylor (Culham Lab., Abingdon, Berks, Eng.). Phys. Fluids, 7: 767-63 (June 1964). (CLM-P36)

It is shown that an appropriate choice of variables can greatly simplify the discussion of equilibrium and stability of low-pressure plasma in arbitrary mirror fields. One specifies by α and β the line of force on which a particle is moving and also specifies its adiabatic invariants μ, J; the energy of the particle is then determined as a function $K(\mu,J,\alpha,\beta)$ which plays the role of a hamiltonian. Any equilibrium distribution can then be written in the form $F\{\mu,J,K(\alpha,\beta,\mu,J)\}$, and it is shown that a sufficient criterion for such distributions to be stable against interchanges is $(\partial F/\partial K)_{\mu J} < 0$. Necessary and sufficient criteria are also derived. When approached in this way, the exact form of the field configuration only enters the problem through the determination of the function K, which may be easily calculated. In general a comprehensive view of plasma behavior, convenient for the discussions of equilibrium, confinement and stability, can be obtained from the structure of the $K(\alpha,\beta,\mu,J)$ = constant contours. An example of the application of this approach to a Ioffe stabilized mirror is described. This confirms the existence of stable plasma equilibria in this field configuration. (auth)

26745 PLASMA STABILITY CRITERIA FROM CONSERVATION LAWS. C. Oberman and J. Dawson (Princeton Univ., N. J.). Phys. Fluids, 7: 773-7(June 1964). (MATT-210)

It is shown that the Penrose criteria for the existence of unstable electrostatic oscillations of a Vlasov plasma can be derived simply from the energy-momentum conservation laws applied to marginally unstable modes. These criteria also are obtained variationally as necessary conditions for instability by extremizing the possible motions that can convert kinetic energy into electric field energy. (auth)

26746 SOLITARY WAVES IN A COLLISION-FREE PLASMA WITH AN ISOTROPIC PRESSURE. J. G. Cordey (Univ. of London). Phys. Fluids, 7: 778-82(June 1964).

The effect of an isotropic pressure on longitudinal nonlinear plasma waves is investigated. Two distinct types of solitary wave solutions are found, one similar to the nonlinear zero pressure wave and a new type which is best described as a solitary wave within a solitary wave. The order of magnitude of the width of the first type of wave and the outer part of the second is the geometric mean of the gyroradii of the ions and electrons when moving with the Alfvén speed. It is found that the isotropic pressure shortens the width of the first type of wave. Both cases of unequal and equal ion and electron temperatures are investigated for the two types of waves. (auth)

26747 PERTURBATION METHOD FOR WAVES IN A SLOWLY VARYING PLASMA. David E. Baldwin (Stanford Univ., Calif.). Phys. Fluids, 7: 782-91(June 1964).

The method of expansion in instantaneous eigenfunctions is used to obtain approximate solutions to the linearized Vlasov equation when the unperturbed function is time-dependent. The method is useful when the time-dependence of the unperturbed function is slow compared with the plasma frequency. The general results are used to obtain the growth of wave energies in the quasilinear limitation of weak two-stream instabilities. Deviations from previous results for this problem are found. (auth)

26748 KINETIC THEORY OF THE CLASSICAL ELECTRON GAS IN A POSITIVE BACKGROUND. I. EQUILIB-

RIUM THEORY. Ralph L. Guernsey (Univ. of Maryland, College Park). Phys. Fluids, 7: 792-802(June 1964).

An approximation scheme is developed for calculating the equilibrium properties of a system containing both short-range and weak long-range interactions. The results are applied to the calculation of the pair correlation and equation of state for an electron gas in a neutralizing background. Although the starting point is the Bogoliubov–Born-Green–Kirkwood–Yvon hierarchy, the short-range divergence usually encountered in the "dynamic" approach is avoided, and the results (calculated through second order in the plasma parameter) are found to be in agreement with previous calculations by diagrammatic methods. (auth)

26749 TRANSFER OF ENERGY IN A QUANTIZED PLASMA. S. Rand (Inst. for Defense Analyses, Washington, D. C.). Phys. Fulids, 7: 807-13(June 1964).

The exchange of energy between a plasma and a test particle in a time-independent potential was studied. The motion of the test particle and the plasma interactions are treated quantum mechanically. A general formula, obtained for the energy transfer, is applied to the problems of the free particle and to the linear harmonic oscillator in the dipole approximation. Contributions to the energy transfer are separated into parts associated with friction and with thermal agitation or velocity diffusion. The results are compared with the classical limits. For the free particle, the corrections to the classical results are logarithmic, whereas for the harmonic oscillator the corrections are very important, when the oscillator transition energies exceed the random electron energies in the plasma. The frictional contribution to the energy loss by the oscillator is related to the electric conductivity. (auth)

26750 FIELD CORRELATION FUNCTIONS IN A PLASMA. I. Oppenheim (Massachusetts Inst. of Tech., Cambridge) and N. G. van Kampen. Phys. Fluids, 7: 813-15(June 1964).

The correlation function between the electrostatic field at point a and the electrostatic field at point b in a fully ionized hydrogen plasma is computed. The correlation function is shown to be a long-range function of the distance between points a and b. This result has significance in the treatment of transport properties in a plasma. (auth)

26751 AXIALLY SYMMETRIC FORCE-FREE PLASMOIDS. Daniel R. Wells (Princeton Univ., N. J.). Phys. Fluids, 7: 826-32(June 1964).

The theory of force-free magnetic fields is applied to equilibrium configurations of an incompressible fluid with axisymmetric motions. It is demonstrated that solutions satisfying collinear force-free flow satisfy the vorticity equation for zero viscosity. Experimental measurements of the magnetic and flow fields of the plasmoids generated by a conical θ-pinch plasma gun are shown to be in agreement with the solutions to these equations. (auth)

26752 PROPAGATION OF A REFLECTED SHOCK WAVE IN A TRANSVERSE MAGNETIC FIELD. Yolande Boublil and Kenneth B. Earnshaw (National Bureau of Standards, Boulder, Colo.). Phys. Fluids, 7: 876-81(June 1964).

Shock waves are reflected from a wall in the presence of a transverse magnetic field. The gas is highly ionized and therefore the lines of force can be considered frozen in. In such a case the magnetic field is compressed and the Rankine–Hugoniot relations, including magnetic pressure and magnetic energy as given by de Hoffmann and Teller, are used. The magnetic probes show an increase of the magnetic field behind the reflected shock, and the velocity of the reflected shock waves increases with increasing fields. For a constant incident velocity, the dependence of the reflected shock velocity on the magnetic field is given by a linear function: $U_r^2 = a + bB^2$ where a and b are constant in a first approximation. This law was verified by experimental results. (auth)

26753 DYSON EQUATION TECHNIQUE IN NONEQUILIBRIUM STATISTICAL MECHANICS. G. Kalman (Faculte des Sciences, Orsay, France). Phys. Fluids, 7: 910-11 (June 1964).

It is shown that the technique of the Dyson equation can be applied to diagram summation procedures in nonequilibrium statistical mechanics. The technique is applied to the Vlasov and the Fokker–Planck equations in plasma kinetics. (C.E.S.)

26754 TEMPERATURES OF PLASMAS PRODUCED BY EXPLODING WIRES UNDER WATER. P. M. Sherk (Lockheed Aircraft Corp., Sunnyvale, Calif.). Phys. Fluids, 7: 913-15(June 1964).

Brightness temperatures were measured for plasma resulting from underwater explosions of aluminum, copper, platinum, and tungsten wires. (C.E.S.)

26755 RADIATION CONDITION FOR PLASMA WAVES INTO A VACUUM. George Schmidt (Stevens Inst. of Tech., Hoboken, N. J.). Phys. Fluids, 7: 915-17(June 1964). (SIT-105)

The possibility of radiation by plasma oscillations or waves is discussed. A simple criterion is given for coupling between a plasma wave and outgoing electromagnetic radiation at a plasma-vacuum interface. A plane interface is chosen for simplicity. (C.E.S.)

26756 INCOHERENT ELECTROMAGNETIC SCATTERING FROM DRIVEN PLASMA OSCILLATIONS. Herbert L. Berk (Princeton Univ., N. J.). Phys. Fluids, 7: 917-18 (June 1964). (MATT-230)

Incoherent electromagnetic radiation scattered at Doppler-shifted frequencies about the frequency of the incident beam is discussed. If two beams of different frequencies are incident upon a plasma, radiation incoherently scatters about a well-defined difference frequency. If one of the beams has a frequency ω slightly greater than the plasma frequency, longitudinal plasma oscillations are generated. The induced fluctuations can serve as scattering centers for the incoming radiation of the second beam which is at some higher frequency ω_0. This scattering mechanism produces radiation sharply centered about frequencies $\omega_0 \pm \omega$, and this radiation is scattered into a thin conical shell. The scattering cross section is calculated. (C.E.S.)

26757 LONGITUDINAL WAVE PROPAGATION IN A FULLY IONIZED GAS. David Kahn (Raytheon Co., Waltham, Mass.). Phys. Fluids, 7: 918-20(June 1964).

The propagation of waves in a fully ionized gas is investigated by means of the macroscopic equations of motion. The adiabatic condition on the motion is relaxed by including the energy relaxation terms for the case of zero applied magnetic field (or longitudinal field). Only longitudinal waves are studied. (C.E.S.)

26758 SELF-CONFINEMENT OF PLASMAS. Edward Gerjuoy and Robert C. Stabler (RCA, Princeton, N. J.). Phys. Fluids, 7: 920-1(June 1964).

Previous arguments that a self-confined plasma, or plasmoid, cannot exist (in the absence of gravitational fields) in either the nonrelativistic or relativistic domains are discussed. It is shown that the arguments are valid but may lead to misleading theorems concerning the behavior of actual systems of particles. (C.E.S.)

26759 COMMENTS ON "HIGH-FREQUENCY CONDUCTIVITY OF A FULLY IONIZED PLASMA." Ralph Guernsey (Univ. of Maryland, College Park), C. Oberman, J. Dawson, and A. Ron. Phys. Fluids, 7: 921-2(June 1964).

It is shown that an incorrect evaluation of an integral led to a nonuniformity in the order of the small mass ratio limit and a velocity integration in previous calculations of the h-f conductivity of a fully ionized plasma (NSA 17: 5497). The remarks that this nonuniformity was due to an ion-ion shielding contribution are thus false. (C.E.S.)

26760 MAXIMUM PLASMA PRESSURE FOR CONTAINMENT IN MAGNETIC FIELDS WITH FINITE MINIMA. R. J. Hastie and J. B. Taylor (Culham Lab., Abingdon, Berks, Eng.). Phys. Letters, 9: 241-2(Apr. 15, 1964).

An estimate of the value of limiting β for hydromagnetic stability of equilibria in magnetic fields possessing a nonzero minimum in field strength is obtained. Stability according to both the double adiabatic energy principle and that of Kruskal and Oberman was examined; calculations are presented only for the former. It is concluded that the limiting β in a shallow magnetic well is directly related to the well depth. (M.J.T.)

26761 CONDUCTIVITY TENSOR OF AN ANISOTROPIC QUANTUM PLASMA IN A UNIFORM MAGNETIC FIELD. John J. Quinn (RCA Labs., Princeton, N. J.). Phys. Rev., 135: A181-5(July 6, 1964).

The quantum magnetoconductivity tensor for a system in which the constant energy surfaces are ellipsoids tilted away from the direction of the d-c magnetic field is derived. The results are applied to a system with cubic symmetry in which the Fermi surface consists of a set of ellipsoids. The dispersion relation for low-frequency magnetoplasma oscillations (helicons) is investigated, and some qualitative discussion of the attenuation of helicon waves in anisotropic materials is presented. (auth)

26762 MINIMUM-B PLASMA EQUILIBRIA WITH FINITE PRESSURE. Theodore G. Northrop and K. J. Whiteman (Univ. of California, Berkeley). Phys. Rev. Letters, 12: 639-40(June 8, 1964).

The moment equations and the general theory of adiabatic particle motion are used to find equilibrium solutions of the hydromagnetic equations for a high-β plasma, for the case in which the plasma is confined statically by means of mirror fields. It is found that the electric current parallel to the field must be everywhere zero. It is also shown that if surfaces of constant magnetic field are also surfaces of constant pressure, then they are also surfaces of constant guiding-center density. (T.F.H.)

26763 ELECTROSTATIC PLASMA RESONANCES. G. H. Bryant and R. N. Franklin (Royal Military Coll. of Science, Swindon, Eng.). Proc. Phys. Soc. (London), 83: 971-81(June 1964).

It is shown that the resonances observed in microwave scattering from a positive column depend on the existence of a radial electron density gradient. Deductions are made about the boundary conditions governing the space charge distribution associated with the resonant scattering. A comparison with electrostatic probe measurements shows that subsidiary resonances exist, their position being a function of number density and probing frequency. The principal resonance depends also on the external geometry. It is a feature of measurements made in this way that the principal resonance occurs at a frequency somewhat less than the mean plasma frequency. (auth)

26764 PLASMAS—LABORATORY SCALE. Bo Lehnert (Royal Inst. of Tech., Stockholm). Rev. Geophys., 2: 225-73(May 1964).

The present state of plasma physics research in the laboratory is reviewed. Important applications and related problems are summarized and are illustrated by a number of experimental results. Attempts to bring theory and experiments into quantitative agreement are especially emphasized. 185 references. (auth)

26765 MICROWAVE INVESTIGATIONS OF GAS-DETONATION PLASMAS. B. Koch, H. Freiwald, and H. W. Koch (Deutsch-Französisches Forschungsinstitut, St.-Louis (Ht. Rhine), Frankreich, [Ger].). Z. Naturforsch., 19a: 396-8(Mar. 1964). (In German)

An investigation was made of detonation reactions in gas mixtures. The mixture was ignited at the end of a strong-walled metal tube by means of an exploding wire from a condenser battery. Microwaves studies were made either by the reflection on the front in the form of a Doppler signal or by permeability in the form of an amplitude registering of a test signal. Results are shown for detonation velocity measurements on two different $C_2H_2-O_2$ mixtures. (M.C.G.)

26766 KINETIC THEORY OF PLASMA WAVE INTERACTION. V. P. Silin. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 1, 31-40(Jan.-Feb. 1964). (In Russian)

Equations for nonlinear interactions of plasma oscillations with Coulomb interactions were obtained without considering interference from self-force and resulting divergence. Liouville equations were used for describing correlative plasma particle functions. (R.V.J.)

26767 ON THE THEORY OF HETEROGENEOUS PLASMA STABILITY IN MAGNETIC FIELD. A. M. Fridman. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 1, 99-101 (Jan.-Feb. 1964). (In Russian)

Previous studies of dissipative effects (finite conductivity) revealed an instability in heterogeneous plasma that rapidly diffused across the magnetic field. Moreover, previous investigations differentiated between a high temperature plasma (in which collisions were neglected) described by kinetic equations and a relatively cool plasma described by hydrodynamic equations. Plasma stability in the intermediate case, in which electron motion is described by hydrodynamic equations and ion motion is described by kinetic equations was investigated using a heterogeneous isothermal plasma in a strong magnetic field ($H^2 > 8\pi p$, where p is plasma pressure). In contrast to homogeneous plasma, in a heterogeneous plasma the dielectric properties vary with small spatial gradients. Wave oscillations with phase velocities coinciding at the expense of a density gradient, with electron drift velocities were investigated for the case in which the perturbation wave vector is perpendicular to the magnetic field and the length of the wave is larger than the electron free path. (R.V.J.)

26768 INVESTIGATION OF WEAKLY IONIZED HELIUM PLASMA IN MAGNETIC FIELD. S. G. Alikhanov. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 1, 101-4(Jan.-Feb. 1964). (In Russian)

Helium plasma diffusion time in a 5000-gauss magnetic field was studied using a small (1.6 cm) tube with electron concentrations of 10^8 to $10^{10}/cm^3$. The results of the experiment are not in agreement with classical diffusion formulas. The measured supplementary plasma flux at the wall is in reverse proportion to the magnetic field intensity and is not a function of neutral gas pressure in the range 0.05 to 0.02 mm Hg. The obtained effect is in agree-

ment with the Sagdeev theory on plasma turbulent diffusion. (R.V.J.)

26769 THEORY OF TRANSPORT IN NONISOTHERMAL TOTALLY IONIZED PLASMA. L. M. Gorbunov and V. P. Silin (Moscow Inst. of Physics). Zh. Tekhn. Fiz., 34: 385-94(Mar. 1964). (In Russian)

Expressions were developed for the current density, thermal flux, and electron viscosity in non-isotropic plasma. Effects of electron interactions with plasma oscillations on the transport coefficient were determined. Transport coefficients for conditions in which the electron temperature is considerably higher than ion temperature were found to differ from coefficients obtained by considering pair collisions only. A region in which interactions with plasma oscillations demand relatively small corrections was found. (tr-auth)

26770 SOLUTION FOR A PROBLEM IN QUASI-STATIONARY ELECTRODYNAMICS BY THE METHOD OF IMAGES. M. L. Levin. Zh. Tekhn. Fiz., 34: 395-8(Mar. 1964). (In Russian)

The problem of ring current interactions with an ideally conducting sphere with its center located at the ring axis was studied in relation to plasma bunch acceleration. An accurate solution containing a Legendre polynomial was found. (R.V.J.)

26771 TRANSPORT EQUATIONS FOR A THREE-COMPONENT PLASMA IN A MAGNETIC FIELD. I. P. Stakhanov and A. S. Stepanov. Zh. Tekhn. Fiz., 34: 399-409(Mar. 1964). (In Russian)

Transport equations describing volt-amp characteristics were developed for diffusion in plasma thermoelements ($\lambda/L \ll 1$, where λ is free-path length, and L is the gap between electrodes) with unlimited magnetic field. (R.V.J.)

26772 ANOMALOUS PLASMA DIFFUSION IN MAGNETIC FIELD. G. M. Zaslavskii and S. S. Moiseev (Novosibirsk State Univ., USSR). Zh. Tekhn. Fiz., 34: 410-18(Mar. 1964). (In Russian)

Two-fluid hydrodynamic studies were made of heterogeneous plasma stability considering viscosity, thermal conductivity, and longitudinal current dissipative effects. Anomalous diffusion coefficients were found for various asymptotic maximum cases. (tr-auth)

26773 STEADY-STATE AXIALLY-SYMMETRIC FLOW OF PLASMA ACROSS AXIMUTHAL MAGNETIC FIELD. A. I. Morozov and L. S. Solov'ev. Zh. Tekhn. Fiz., 34: 429-43(Mar. 1964). (In Russian)

Hydrodynamic flow of ideally conducting plasma in axially-symmetric channels was investigated, and approximate solutions were found for narrow channels and for slowly changing parameters of flow along the axis. (tr-auth)

26774 STREAMLINE FLOW OF CONDUCTING COMPRESSIBLE FLUID AROUND ELECTRIC CONDUCTOR. V. I. Tokatly. Zh. Tekhn. Fiz., 34: 444-7(Mar. 1964). (In Russian)

Streamline flow of a compressible conducting nonviscous ideal gas around an electric conductor was analyzed using a linear approximation. A concrete example in which the conductor is in hydrogen plasma at temperature $T_0 = 10^4$ °K, density $n_0 = 10^{16}$, and velocity $V_0 = 2 \times 10^6$ cm/sec was examined. (R.V.J.)

26775 PLASMA INTERACTIONS WITH A HIGH-FREQUENCY FIELD IN THE PRESENCE OF A CONSTANT HOMOGENEOUS MAGNETIC FIELD. Yu. A. Berezin, T. I. Gutkin, S. N. Lozovskii, and T. R. Soldatenkov. Zh. Tekhn. Fiz., 34: 448-53(Mar. 1964). (In Russian)

Steady-state cylindrical configurations are found for fully ionized two-component plasma interacting with a high-frequency field in the presence of a constant magnetic field. (tr-auth)

26776 SPACE POTENTIAL IN STATIONARY PLASMA DISTURBED BY HETEROGENEOUS HIGH-FREQUENCY FIELD. K. S. Golovanivskii, V. D. Dugar-Zhabon, and A. A. Kuzovnikov (Moscow State Univ.). Zh. Tekhn. Fiz., 34: 454-7(Mar. 1964). (In Russian)

Previously it was shown that in a positive column in an external heterogeneous high-frequency field a change in the diffusion rate results in a redistribution of ion densities, changes in radial diffusion currents, and specific space potential distribution. Measurements were taken on the radial distribution of the space potential in the positive column of plasma interacting with an external heterogeneous high-frequency field. The measurements were made using helium at 0.31 mm Hg, 20 ma discharge current, and 1.3 Mc field frequency. The high-frequency potential on the spherical electrode with respect to ground was 65 v. (R.V.J.)

26777 PROBE BEAM INVESTIGATION OF HIGH-FREQUENCY PLASMA OSCILLATIONS IN A MAGNETIC FIELD. V. D. Fedorchenko, V. I. Muratov, and B. N. Rutkevich. Zh. Tekhn. Fiz., 34: 463-8(Mar. 1964). (In Russian)

Electron produced plasma in a strong magnetic field (to 3000 gauss) in a gas at 10^{-5} to 10^{-4} mm Hg oscillated at 25 to 50 Mc. Electron beam probing indicated oscillation propagation at 5.7×10^8 cm/sec with an amplitude of 7 v/cm. Fast escape of electrons from plasma created a considerable potential in the beam. (tr-auth)

26778 MEASUREMENTS OF HIGH-FREQUENCY FIELDS IN PLASMA WAVEGUIDE. O. G. Zagorodnov, L. I. Bolotin, and V. D. Bakhtin. Zh. Tekhn. Fiz., 34: 469-73(Mar. 1964). (In Russian)

The topography of electric and magnetic fields in plasma with or without external axial magnetic field is of interest in relation to charge particle interactions with fields in plasma waveguides. An analysis was made of the radial distribution of the electric field longitudinal component in a plasma waveguide without an external axial magnetic field, and the absolute values for retardation from $\beta = 0.1$ to 0.7 were measured. (R.V.J.)

26779 BOLOMETRIC DETERMINATION OF PLASMA ENERGY LOSSES AS A FUNCTION OF TIME. L. L. Gorelik. Zh. Tekhn. Fiz., 34: 496-504(Mar. 1964). (In Russian)

Plasma energy dissipation as a function of time was determined by a special triple-layer bolometer with a sensitivity of 10^{-3} j/cm^2 and resolving time of 10 μsec. Descriptions are given of the bolometer design and performance and improved measuring methods. (tr-auth)

26780 NEW TRIPLE-LAYER BOLOMETERS FOR MEASURING PLASMA ENERGY LOSSES. L. L. Gorelik and V. V. Sinitsyn. Zh. Tekhn. Fiz., 34: 505-8(Mar. 1964). (In Russian)

Descriptions are given of a new bismuth bolometer, with $\sim 10^{-4}$ j/cm^2 sensitivity and ~ 3 μsec resolving time, used with the magnetic trap installation, Orekh. Triple-layer germanium and collodion bolometers used for integral measurements of particle losses during discharge in Orekh showed identical sensitivities of $\sim 10^{-5}$ to 10^{-6} j/cm^2. (R.V.J.)

26781 THEORY OF CHARGED-PARTICLE BEAM INTERACTIONS WITH NONHOMOGENEOUS PLASMA. I. POTENTIAL OSCILLATIONS. V. F. Kuleshov and A. A.

Rukhadze. Zh. Tekhn. Fiz., 34: 576-89(Apr. 1964). (In Russian)

Formulas describing the interaction of charged-particle beams with nonhomogeneous plasma were developed for the case of one-dimensional heterogeneity in which all magnitudes characterizing the plasma (and the beam) depend only on one coordinate. The formulas obtained for the dielectric penetrability, for the plasma-beam system, and for potential plasma-beam oscillations indicated a new type of oscillation frequency which is practically always unstable. (R.V.J.)

26782 MACROSCOPIC INSTABILITY OF PLASMA IN A REFLECTION DISCHARGE. O. S. Pavlichenko, L. A. Dushin, I. K. Nikol'skii, and L. V. Brzhechko. Zh. Tekhn. Fiz., 34: 590-6(Apr. 1964). (In Russian)

An increased diffusion of charged particles in a reflection discharge plasma with a cold cathode in a magnetic field (Pig reflex) which was previously observed was verified. It is shown that the increased diffusion is related to the macroscopic motion of a plasma cylinder appearing near the critical magnitudes of the magnetic field. (R.V.J.)

26783 POSSIBILITY OF CONTAINMENT AND HEATING OF PLASMA IN TOROIDAL TRAPPED WITH CUSPED GEOMETRIC FIELD. D. G. Bulyginskii (Inst. of Physics and Tech., Leningrad). Zh. Tekhn. Fiz., 34: 597-605 (Apr. 1964). (In Russian)

Descriptions are given of an experiment with a device creating a stable confinement and heating of plasma in a toroidal trap with an additional cusped geometric field perpendicular to the main field and capable of conserving adiabatic invariance for the total volume of the trap. (R.V.J.)

26784 NON-LINEAR THEORY OF PLASMA WAVE GUIDE IN A STRONG MAGNETIC FIELD. A. N. Kondratenko. Zh. Tekhn. Fiz., 34: 606-10(Apr. 1964). (In Russian)

A nonlinear kinetic investigation was made of electromagnetic wave propagation in a plasma waveguide cylinder in an infinitely strong magnetic field directed along the waveguide axis. (R.V.J.)

26785 STRUCTURE OF A SEPARATE WAVE PROPAGATING ACROSS A MAGNETIC FIELD. A. D. Pataraya. Zh. Tekhn. Fiz., 34: 617-19(Apr. 1964). (In Russian)

It is shown that in a quasi-neutral plasma, electron and ion inertia induce a separation of charges forming an electrostatic field. The influence of the charge-separation effect on the characteristic magnitudes of a plasma with one wave propagating across a magnetic field was considered, and the problem was resolved by means of perturbation theory. (R.V.J.)

26786 NONMONOTONIC VARIATIONS OF TEMPERATURE AND DENSITY BEHIND A STRONG SHOCK WAVE IN A GAS. S. I. Anisimov (Inst. of Physics, Academy of Sciences, Minsk, USSR). Zh. Tekhn. Fiz., 34: 620-3 (Apr. 1964). (In Russian)

The structure of a shock wave in a gas with two inert degrees of freedom was investigated. It is shown that at certain ratios between time relaxation of the inert degrees of freedom, the density, temperature, and other variables behind the wave front vary in an erratic manner. (tr-auth)

26787 MAGNETOHYDRODYNAMIC BOUNDARY LAYER ON A PLANE STREAM LINED BY A HIGH TEMPERATURE FLUX DURING AN INJECTION OF EASILY IONIZED ADMIXTURES. Yu. N. Smyslov and I. B. Chekmarev (Leningrad Inst. of Physics and Tech.). Zh. Tekhn. Fiz., 34: 630-6(Apr. 1964). (In Russian)

Effects of the magnetic field on the friction resistance and thermal flux on the surface of a solid or porous material were investigated. A combined effect of an injection and magnetic field on the distribution of temperatures and velocities in the conducting layer was examined by using a boundary layer with an external magnetic field and streamlined by a high-temperature inert gas with an identical gas, containing small admixtures of alkali metals, blowing into the porous surfaces. It is assumed that the temperature of incoming flux is not high enough to ionize the inert gas and the wall temperature is high enough to keep the alkali metal in a vapor state at the given gas pressure. The analysis indicated that combined injection of vapors of easily ionized admixtures and effects of magnetic field reduces the surface friction and thermal flux on the boundary layer. (R.V.J.)

26788 RADIATION FROM CYLINDRICAL BUNCHES IN HETEROGENEOUS MEDIUM. B. V. Khachatryan (Erivan State Univ., USSR). Zh. Tekhn. Fiz., 34: 637-44 (Apr. 1964). (In Russian)

Quasiclassical approximations and the theory of perturbations were used for developing expressions describing radiation intensity of charged cylindrical bunches moving uniformly and linearly in a heterogeneous medium. Effects of fluctuations of the length and the order of bunch succession were analyzed. (tr-auth)

26789 THEORY OF POSITRON ANNIHILATION IN IONIZED GAS. I. N. Toptygin (Leningrad Polytechnic Inst.). Zh. Tekhn. Fiz., 34: 645-53(Apr. 1964). (In Russian)

Evaluations were made of the probability of elementary processes in positron interactions with a hydrogen plasma. Production of positrons in triple and pair collisions, photoproduction of positrons, shock ionization, and positron excitations are analyzed. The data obtained are used for determining the mechanism of positron annihilation at various plasma concentrations and temperatures. Experimental data on positron annihilation in plasma describe plasma characteristics and positron-plasma interaction processes. (tr-auth)

26790 THE BEHAVIOR OF FORCE LINES IN A CLOSED STELLARATOR MAGNETIC FIELD IN THE PRESENCE OF DISTURBANCES. A. P. Popryadukhin. Zh. Tekhn. Fiz., 34: 658-65(Apr. 1964). (In Russian)

The effects of small disturbances on the behavior of force lines in a stellarator magnetic field were studied. Under certain conditions small perturbations induce considerable distortions of magnetic surfaces. Evaluations were made of magnetic surfaces in magnetic fields distorted by a dipole. (tr-auth)

26791 RADIATION OF A CHARGE MOVING IN NONHOMOGENEOUS MAGNETOACTIVE MEDIUM. K. A. Barsukov (Lebedev Inst. of Physics, Moscow). Zh. Tekhn. Fiz., 34: 725-30(Apr. 1964). (In Russian)

Investigations were made of the radiation of a charged particle in nonisotropic medium in nonhomogeneous magnetic field. Expressions were developed describing the charge energy losses during its motion along the periodic field space. (tr-auth)

26792 SPECTROSCOPIC STUDIES OF TOROIDAL DISCHARGE. V. G. Averin, M. A. Mazing, and A. I. Pisanko. Zh. Tekhn. Fiz., 34: 767-8(Apr. 1964). (In Russian)

Plasma radiation as a function of time was previously

studied with alpha, zeta, beta, Scylla, Ta-2000, and Tokamax installations. Supplementary data are given for time-dependent intensity of the O VI 1032 Å line in the beta installation. The volume of condenser was increased to 10^4 μf, discharge time to 1100 μsec, and maximum discharge current to 120 ka. The curve of the electron temperature calculated according to O VI and O V is given. The electron temperature calculated for the O VI 1032 Å line was found to be 40 ev. (R.V.J.)

26793 ÉLECTRODYNAMIQUE DES PLASMA. FONDÉE SUR LA MÉCHANIQUE STATISQUE. TOME I. PROCESSUS PHYSIQUES ET MÉTHODES MATHÉMATIQUES. (Electrodynamics of Plasmas. Based on Statistical Mechanics. Volume 1. Physical Processes and Mathematical Methods). R. Jancel and Th. Kahan. Paris, Dunod, 1963. 640p. 96 F.

The physical processes and properties of plasmas are described, and the mathematical methods developed for their interpretation are presented. Statistical mechanics, transport theory, particle motion, hydrodynamics, and magnetohydrodynamics are among the topics considered. The Boltzmann equation and the methods for solving it are emphasized. (D.C.W.)

26794 KELVIN-HELMHOLTZ INSTABILITY IN A PLASMA AND GEOMAGNETIC MICROPULSATIONS. Amiya Kumar Sen. Thesis, New York, Columbia Univ., 1963. 154p.

The most general form of hydromagnetic Kelvin-Helmholtz discontinuity in ideal plasmas has been considered. The presence of surface tension on the surface of discontinuity and gravity is also assumed. In the incompressible case, two necessary and sufficient criteria of stability have been obtained, in contrast to only one that is usually given. The domains of stability (to all modes of perturbation) are portrayed in parameter space. The effect of compressibility on the stability is brought into focus by considering two limiting cases: a very stiff plasma (of very small compressibility) and a very lumpy one (of very large compressibility). It is found that unlike surface tension, gravity and magnetic field, compressibility can have either stabilizing or destabilizing effects, depending on the stationary state of motion. In general, this may lead to two domains of stability, in contrast to only one that exists in the case of incompressible plasma. The above results are used to develop a new theory of geomagnetic micropulsations, in which the solar wind-exosphere interface is viewed as a surface of hydromagnetic Kelvin-Helmholtz discontinuity. It is shown that the sunlit side of this interface is unstable under most conditions of solar activity. Only during moderate and intense solar activity, the unstable waves thus generated may leave the interface along the lines of force of the earth's magnetic field and appear at the surface of the earth as micropulsations. Some of the important features of micropulsations, like the bandwidth and higher occurrence frequency in the daylight hours and auroral zones, are explained by the theory. (Dissertation Abstr.)

26795 THE ONSET OF AN ELECTROMAGNETICALLY DRIVEN SHOCK WAVE. Richard Blanchard Block. Thesis, Cleveland, Case Inst. of Tech., 1963. 112p.

The energy balance of an annular electromagnetic shock tube is investigated. The total energy to the shock tube is measured and compared with the effective energy in the shock wave after the driving current has vanished. The difference between these two energies is explained by losses during the first half cycle of the discharge. Simultaneous measurements of the magnetic field and luminous front indicate that these two fronts are coincident over a major part of the half cycle of the total current. Only at a time when the total current to the shock tube is considerably smaller than the peak current does a separation exist. Fluctuations in the magnetic field between the electrodes and significant trapped magnetic fields in the plasma ejected from the end of the electrodes are observed and a tentative explanation is presented for this phenomenon. Data extracted from smear camera pictures indicate that either a current piston shock wave model or a model based on simple momentum considerations predict the velocity of the luminous front at the exit of the electrodes, and that a blast wave model closely approximates the attenuation of the shock wave down the tube. Spectroscopic measurements of the electron density behind the shock wave are in approximate agreement with the electron density computed with the Hugoniot relationships. Open shutter spectrograms show that both iron and nitrogen impurities are present in the hydrogen gas ejected from the electrodes. (Dissertation Abstr.)

26796 SPATIAL RESOLUTION OF EXTERNAL DETONATION-GENERATED PLASMAS. Gilbert Calder Barton. Thesis, Salt Lake City, Univ. of Utah, 1964. 117p.

The effect of the presence of air at different pressures upon the electrical conduction and the luminosity of external detonation-generated (d.g.) plasmas has been measured using electrostatic probes and a tracer method. An indium tracer was used to determine the position of the detonation products as the external d.g. plasma traveled down the length of the constraining tube. Detection of light from the radiating indium was accomplished using a photomultiplier tube centered on the 4511 Å indium line of a spectrograph and reflecting the light from the detonation into the spectrograph. Since electrons have much larger diffusion coefficients than ions, the position of the free electrons from the reaction zone of the explosive could be determined by following the radiating explosive ions down the length of the constraining tube, via the indium tracer. That is, the electrons should either diffuse ahead of the ions, or at least travel at the same velocity. It was found that the radiating indium ions were in the main body of the highly luminous external d.g. plasma (for at least 34 mm of its initial path, which was the extent of the extensive luminosity probing). At initial pressures of approximately 10^{-3} mm Hg the luminosity was negligible, showing that the air molecules act as a collision medium with which the propelled explosive molecules collide and are thus excited or de-excited sufficiently to radiate in the visible spectral range. At pressures of initially 10^{-3} mm Hg, precursor electrons were found to travel at approximately twice the velocity of the radiating ions near the charge end, and to travel at speeds greater than twice that of the ions 800 mm from the free end of the charge, thus showing a definite separation of the electrons from the radiating ions. No such separation was observed in air at atmospheric pressures. Electrical conduction within 50 mm of the free end of the charge was unaffected by the presence of air molecules at pressures of either one atmosphere or at initial pressures of 10^{-3} mm Hg. Glass plates placed over the free end of the charge allowing the shock to be transmitted, but filtering electrons coming from the reaction zone of the explosive, showed that the electrical conduction was substantially eliminated. Hence, the high electron densities causing the high electrical conduction of external d.g. plasmas was established as originating from the reaction zone of the explosive, whereas the luminosity was dependent upon both the explosive molecules and the air molecules. (Dissertation Abstr.)

26797 EXPERIMENTAL INVESTIGATIONS INTO THE PRODUCTION OF HIGH-DENSITY GASEOUS PLASMAS. Edward Paul Bialecke, Jr. Thesis, Urbana, Ill., Univ. of Illinois, 1963. 143p.

Experimental studies of the production of a high-density plasma are described. High-density plasmas with electron number densities on the order of 10^{15} to 10^{16} electrons/cc are formed using neon and hydrogen gases. A theta pinch is produced by discharging a capacitor bank through a one-turn-coil, inductively coupling a current into the plasma, and compressing the plasma with a large magnetic field. The production of the high-density plasma is studied using various diagnostic techniques. High-speed photographs of the motion of the high-density plasma are made using both streak and framing photographs. The speed of the implosion of the theta pinch is determined for various neutral gas pressures and capacitor bank voltages. The radial distribution of the relative electron density in the pinched plasma is determined from framing photographs. Microwave transmission and reflection measurements of the afterglow of the high-density plasma are described both theoretically and experimentally. Using frequencies in the 3 cm and 4 mm microwave bands, the electron density and collision frequency can be determined in low-pressure gases through an analysis of the transmitted signal alone. The time interval, in the growth and decay of the high-density plasma, where the microwaves will not propagate is shown to be useful as a method for determining under what conditions the highest electron density in the high-density plasma is produced. 30 cm microwave band frequencies were used in a coaxial propagation experiment where the pinched plasma forms a center conductor of a coaxial line with the one-turn-coil. No such propagation was observed and the reasons for this are discussed. Microwave noise emitted by the plasma was sought for a determination of the electron temperature in the plasma. The plasma is found to be a poor black-body radiator, and, hence, no microwave noise radiation from the plasma was observed. Distortions in the impressed magnetic field due to the dense plasma are measured and analyzed. The current flowing in the plasma can be determined from a comparison of the axial magnetic field when the plasma is present with that due only to the current in the one-turn-coil. Plasma currents of 10,000 amperes to 60,000 amperes are measured. Direct measurement of the axial electron density in the hydrogen high-density plasma is found using the Stark broadening of the H_β hydrogen spectral line. Electron densities of up to 2×10^{16} electrons/cc are determined to be present in the theta pinch plasma. A complete time record of the growth and decay of the high-density plasma is found. Discrepancies between the electron densities in the decay of the high-density plasma as measured by the Stark broadening method and those projected from the microwave measurements are found and discussed. (Dissertation Abstr.)

26798 DIAGNOSIS OF PLASMA CYLINDERS BY ANGULAR SCATTERING OF MICROWAVES. Ronald Lester Easley. Thesis, Tuscaloosa, Ala., Univ. of Alabama, 1963. 86p.

The determination of the electron density and collision frequency of a plasma cylinder through the measurement of the angular distribution of free space, electromagnetic waves scattered by the cylinder was investigated experimentally. A 20 kilowatt, d-c arc, argon plasma jet formed a cylindrical plasma requiring no containing walls. Angular scattering distributions were measured at 35 and 72 kmc. A 72 kmc microwave interferometer provided an independent measurement of the plasma properties. Numerical values for the magnitude and phase of the scattered field were obtained using an IBM 7090 computer to solve the scattering problem for a homogeneous, infinitely long, plasma cylinder for a range of electron densities and collision frequencies. The plasma jet was found to have a rapidly decreasing electron density as a function of radius. The value of angular scattering measurements in measuring the properties of such inhomogeneous plasma cylinders is shown. (Dissertation Abstr.)

26799 CHARGED PARTICLE ESCAPE FROM A STEADY STATE PLASMA IN A MIRROR MAGNETIC FIELD. P. K. John. Thesis, Columbus, Ohio, Ohio State Univ., 1963. 70p.

Charged particles were observed coming out of the ends of a plasma produced in a magnetic mirror field. Currents were measured to identical shielded Faraday cups, located at each end of the magnetic mirror. An axially directed current flow through the plasma was observed. It was shown that this current is attributable to the location of the external ionizing electrodes with respect to the center of the magnetic bottle and that the direction of flow of the current can be controlled by the position of the electrodes. In another facet of the experiment, the axially directed current was eliminated and the current collected by a Faraday cup was measured as a function of the potential applied to it. By finding the slope of the current versus potential curve, energy distributions were obtained for the escaping ions and electrons. In the typical case of a plasma obtained by ionizing deuterium at 3.5 microns, the ions showed an average energy of about 60 ev and the electrons about 20 ev. A charge density of the order of 10^{8} was estimated, using the mirror escape condition and assuming a Maxwellian distribution. A low intensity electron beam sent axially through the plasma was found to affect the axially directed current considerably. The effect was most pronounced at the magnetic field at which the axial current changed direction. In a typical case, at the magnetic field corresponding to zero axial current, the electron beam increased the axial current from zero to 0.8 milliampere. (Dissertation Abstr.)

26800 SOME COMPUTER EXPERIMENTS WITH A ONE-DIMENSIONAL PLASMA MODEL. Craig Gary Smith. Thesis, Princeton, N. J., Princeton Univ., 1963. 177p.

The instability which results from the passage of a current through a plasma is numerically investigated by following with a computer the exact one-dimensional trajectories of a system of charge sheets. The model consists of 2000 sheets of two species, one of which carries the opposite charge and different mass from the other. These sheets are parallel and constrained to move on a common axis perpendicular to the plane of each sheet, but are free to interpenetrate one and another in the course of their motion. The dynamics is determined by the self consistent electric micro-field. The forces between sheets are long range so that this model exhibits the real plasma properties of collective, as well as individual, particle motions. The kinetic equation for the model is derived by a standard technique and put to test with a computer experiment in which initial Maxwellian ion and electron distributions at different temperatures relax towards equilibrium. The relaxation time agrees with that estimated from the kinetic equation, and the rate of formation of the Debye shielding clouds suggests that the correlation function does indeed relax on a very short time scale, as is assumed in the theory. The lowest order kinetic de-

scription of the plasma model is the usual one-dimensional Vlasov equation, whose linearized version predicts that, for certain velocity distributions, perturbations about local charge neutrality grow exponentially in time without bound. The question to which this investigation is addressed is: to what levels will the amplitude of the unstable modes grow before being limited by nonlinear effects, and what quasi-equilibrium state will the plasma seek so as to prevent further growth. Two computer experiments are reported. Except for the current imposed upon the plasma, the initial conditions for each were the same. The ion/electron mass and temperature ratios were chosen to be 25 and 0.1, respectively, while the electron temperature was assigned so as to provide 50 particles per Debye length. The two experiments—the parameter for which is the ratio of uniform drift velocity to thermal spread for the electrons—are identified as Ion-Wave (0.6) and Two Stream (2.6), respectively, low and high current cases. Since previous investigations of streaming instabilities have ascertained that the random energy is enhanced during the growth of the instability at the expense of the ordered motion, an externally applied electric field was introduced in the model for both cases and so programmed as to maintain a constant drift current. The results of the Ion-Wave experiment are in agreement with the qualitative features of recent "quasi-linear" theories. There actually was little outward indication that the plasma was unstable, for the modes did not sustain steady growth. However, there was amplification of the noise level on the potential and current signals. In velocity space the instability distorted the distributions into a shape which clearly was stable. In the Two Stream experiment the model responded to the current constraint with a violent instability which was characterized by an anomalous electrical resistance, the dissipation from which rapidly heated the plasma. The growth of the instability halted after the heating elevated the electron thermal velocity to the level of the drift velocity. The potential energy in the unstable modes sustained steady exponential growth, in agreement with linear growth rates, for some three e-folding times and then broke into oscillations. The amplitudes built up to such high levels that the diffusion in velocity space was not limited to the immediate neighborhood of the phase velocity of the waves, and as a result the distribution became quite distorted. The turbulent state to which the plasma was driven by the instability was able to limit the growth before the distribution completely reached what, by the criterion of linear theory, would be a stable configuration. (Dissertation Abstr.)

26801 LINEARIZED TRANSPORT CONSIDERATIONS OF A TWO-TEMPERATURE MAXWELLIAN PLASMA. Jacob Joseph Gustincic. Thesis, Cleveland, Case Inst. of Tech., 1963. 98p.

The problem of electron oscillations about an equilibrium plasma having a temperature anisotropy described by a two-temperature Maxwellian distribution function is analyzed by means of the linearized Boltzmann transport equation with no collision terms. A model of the plasma is developed from the concept that the plasma fields create polarization charge from the equilibrium plasma background by accelerating charges and causing excess electrons and positive holes in the electron gas structure. The properties of the plasma as a medium for waves is discussed in terms of this model. From considerations of the model, the complete formal solution for the time behavior of the electron oscillations in an external uniform magnetic field is obtained. With no external magnetic field applied, the effect on the temperature anisotropy upon the usual "Landau" modes is considered and it is also shown that for a moderate temperature anisotropy there exists but one instability, that corresponding to a purely growing wave. The effect of mode coupling upon this instability is investigated and the growth rate is calculated as a function of the wavelength. The existence of this growing instability in a uniform externally applied magnetic field is also demonstrated. (Dissertation Abstr.)

26802 INVESTIGATION OF THE ATTENUATION OF SHOCK WAVES PROPAGATED THROUGH A SLIGHTLY IONIZED GAS IN THE PRESENCE OF A TRANSVERSE MAGNETIC FIELD. Salvatore P. Carfagno. Thesis, Philadelphia, Temple Univ., 1963. 193p.

The primary objective of this study was to investigate the attenuation of shock waves propagated through an electrically conductive gas in the presence of a transverse magnetic field and to correlate the observations with the theory of magnetohydrodynamics (MHD). The apparatus was arranged so that experiments could be performed under conditions of subsonic, as well as supersonic, gas flow. It was centered about a 1 in. diameter shock tube with a glass, low-pressure section in which air or argon was ionized by application of an r-f electric field in the axial direction. In most experiments a transverse magnetic field was obtained with permanent magnets. The crossed oscillatory (r-f) electric field ($\vec{E}$) and steady magnetic field ($\vec{B}/\mu$) caused an oscillatory electric field to be generated in a transverse ($\vec{B} \times \vec{E}$) direction. When the gas was set in motion a steady electric field was induced in the $\vec{v} \times \vec{B}$ direction, (having the same line as the $\vec{B} \times \vec{E}$ direction), where $\vec{v}$ is the gas velocity. Steady induced currents generated by the steady component of induced electric field were expected to interact with the applied magnetic field, thereby producing a drag force on the gas and causing a reduction of the speed of the shock wave. However, the attainment of a degree of ionization ($\beta \sim 10^{-6}$) much smaller than had been anticipated led to the prediction of such small induced currents that the MHD effect was expected to be negligibly small. Nevertheless, the experiments indicated that substantial reduction of shock speeds occurred under several conditions, all involving a magnetic field produced by permanent magnets. There appeared to be an accleration, instead of a deceleration of the shock waves when an electromagnet was used; but there were indications that this might be ascribed to pecularities of the magnet used. A variety of auxiliary investigations were conducted, some with the ionized gas at rest or in steady flow, in attempting to discover the cause of the unexpectedly large changes in shock speed. High speed movies were taken of the ionized gas as a shock wave was propagated through it; the influence of gas pressure on discharge current was observed and correlated with theory; and some aspects of the Hall effect were also observed and correlated with theory. The results of these experiments led to a qualitative picture of the behavior of a high frequency discharge as a shock wave is propagated through it. Most important with regard to the primary objective of the study, some evidence was obtained that the induced oscillatory electric fields were substantially higher than expected and that some rectification of oscillatory currents occurred. It is concluded that the observed influence of the magnetic field on shock speed probably resulted from an MHD interaction involving transverse currents not considered by the usual theoretical model. The nature of the transverse currents was only partly established by the experiments. The possible contribution to shock wave attenuation by other phenomena such as boundary layer drag, which is theoretically enhanced in MHD

channel flows involving transverse magnetic fields, is discussed. (Dissertation Abstr.)

26803 COLLECTIVE EFFECTS ON CYCLOTRON RADIATION IN A PLASMA. Altan M. Ferendeci. Thesis, Cleveland, Case Inst. of Tech., 1963. 59p.

Radiation from a plasma, taking into account the collective effects, is discussed and calculated. The importance of collective effects on cyclotron radiation is shown to have a large influence on the radiation intensities as well as on the broadening of such intensities. Due to the thermal motion of an electron, a collective broadening is obtained for a radiating plasma. In the limit $(\omega_c/\omega_p) \gg 1$, collective effects become unimportant and the electrons radiate individually. Since the screening of a test particle is attributed to the collective behavior of a plasma, radiation from a Debye sphere is calculated and it is found to have a strong dependence on the ratio (ω_c/ω_p). The intensity of harmonics is found to be one order of magnitude greater than that estimated from a single electron radiating in vacuum. The thermal broadening due to collective behavior of electrons in a Debye sphere is also calculated. (Dissertation Abstr.)

26804 CURRENT-LAYER DIFFUSION IN A ONE-DIMENSIONAL MAGNETIC PINCH. Theodore John Falk. Thesis, Ithaca, N. Y., Cornell Univ., 1963. 113p.

Diffusion of the current layer at the surface of a compressible electrically conducting gas is analyzed in the case of a one-dimensional pinch. Magnetohydrodynamic equations with finite, scalar, electrical conductivity are used, and the degree of ionization is taken to be constant. A parameter which is proportional to the Alfvén speed divided by the magnetic diffusion speed is derived and used to define two limiting solutions. In the first solution the pinch is fully developed, so that the gas is completely confined by the magnetic body force acting within a thin current layer at the gas surface. In this limit it is shown that the inertia terms in the momentum equation can be neglected. The total current flowing through the gas is then assumed to be constant, and numerical solutions are obtained for the magnetic field and thermodynamic state of the gas within the current layer in terms of a similarity variable. Results are presented for three values of the ratio of thermal-diffusion length to magnetic-diffusion length, the values ranging from greater than one to much less than one. The gas boundary is found to be displaced from its infinite-conductivity position by a distance that is of the order of magnitude of the current-layer thickness. Comparison of constant-conductivity results with temperature-dependent-conductivity results shows that the temperature dependence significantly reduces the displacement of the gas boundary when the ratio of thermal-diffusion length to magnetic-diffusion length is small. The second solution obtained represents the initiation of the pinch, the limit in which the inertia terms are large. The magnetic field is calculated without considering the effect of gas motion, and the gas motion is then obtained from the known driving field. With the total current chosen to vary with a power of the time, a solution is derived which consists of two parts, one valid in the immediate vicinity of the wall and the other in the portion of the current layer not influenced by the wall. Although the limiting solution is not valid over a time period of sufficient length to permit complete development of the pinch, there is some indication of an ultimate decrease in wall pressure and the onset of pinch. (Dissertation Abstr.)

26805 ON THE PROPAGATION OF SMALL AMPLITUDE WAVES IN GASDYNAMIC CHANNEL FLOWS. Stanley Gerald Rubin. Thesis, Ithaca, N. Y., Cornell Univ., 1963. 114p.

The asymptotic behavior of small unsteady perturbations, which are superposed on an equilibrium magnetogasdynamic channel flow, is considered. Two geometries are treated; the so-called "crossed-fields" channel, where the applied magnetic field and velocity field are perpendicular to each other, and the "aligned-fields" configuration, where the magnetic and velocity fields are parallel. Only those channels with slowly varying cross-sectional area and small characteristic width-to-length ratio are allowed, so that changes along the channel are much smaller than are variations across the channel. Under these conditions and the provision that the current density inside the duct is small, a set of "quasi-one-dimensional" equations is obtained. From the resulting set of hyperbolic equations, the theory of characteristics provides certain compatibility relations which describe the behavior of small disturbances of the steady channel flow, which are caused by some local pressure fluctuation. Two distinct wave motions are present within the channel, and the asymptotic behavior of both is examined with the use of the aforementioned compatibility relations. It is shown that under certain conditions, on the magnetic field distribution, wave motions which lead to shock formation in ordinary gasdynamic flow will attenuate due to the action of the magnetic field. (Dissertation Abstr.)

26806 MATERIALS IN GAS DISCHARGES. R. A. Dugdale (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.61-79 of "Advances in Materials. Inter-Disciplinary Symposium, First and Second Sessions, 6 April, 1964." London, The Institution of Chemical Engineers, 1964.

Intense gas discharges, such as those employed in thermonuclear research, cause a number of significant effects to occur on material surfaces exposed to them. An experimental investigation of some of these effects was made and the results obtained are described. The initiation of arcing on metal surfaces appears to involve bursts of vapor generated by the electric breakdown of insulating inclusions, but an essential factor is associated with other surface contamination and may involve electron emission at fields of order 10^5 vcm^{-1}. Intense heat pulses delivered to glasses and ceramics cause surface damage by thermal shock, evaporation, and erosion; the nature of the effects appears to depend on the magnitude and duration of the heat pulse, the dynamics of moving cracks, the thermal properties and microstructure of the materials. Cracking of metal surfaces occurs on the repeated application of heat pulses of sufficient intensity. Sputtering of glasses and ceramics by argon ions from a 12 kv ion gun is sensitive to ambient temperature and angle of incidence; evaporation from thermal spikes is proposed as the important mechanism. (auth)

26807 ZAGADNIENIA MAGNETOGAZODYNAMIKI. CZESC I. (Problems of Magnetogasdynamics. Part I). Krystyn Bochenek, Anna Brahmer, Ryszard Gajewski, Eugenia Kaczmarek, Piotr Kucharczyk, Andrzej Skorupski, Andrzej Szaniawski, and Andrzej Turski. Warsaw, Zaklad Narodowy Imienia Ossolinskich Wydawnictwo Polskiej Akademii Nauk, 1963. 232p.

26808 L'ENERGIE THERMONUCLEAIRE. (Thermonuclear Energy). Claude Étiévant. Paris, Presses Universitaires de France, 1962. 134p.

The present knowledge and research on thermonuclear energy are reviewed. As an introduction the growth in the energy needs of the world are briefly discussed. The

topics reviewed are the nuclear fusion reactions, thermonuclear plasma, the particle and energy balances in a fusion operation, conditions for the maintenance of a thermonuclear reaction, confinement problems, description of some magnetic configurations, and the formation and heating of plasma. In conclusion, the principal problems to be solved are briefly summarized. (J.S.R.)

26809 REPETITIVE PULSED ACCELERATION OF PLASMAS DERIVED FROM EXPLODING METAL FILMS. T. L. Rosebrock, D. L. Clingman, and D. G. Gubbins (General Motors Corp., Indianapolis). 37p. (CONF-533-1)

From 3rd Conference on Exploding Wires, Boston, Mar. 1964.

A pulsed plasma accelerator which uses thin metal films as plasma sources is described. The unique features of the unit are the quasiplanar thin film propellant which is stored in solid bulk form, and the vapor deposition technique by which it is introduced into the accelerator. Prior to the construction of the accelerator, experiments were performed which demonstrated proof-of-principle for each of its components. These experiments are described, together with material requirements for the complete accelerator package. Observed operational features of the accelerator are discussed. An alloy of cadmium and zinc was found to function satisfactorily as a propellant. Some difficulty was experienced in identifying a suitable substrate material from which the deposited film would scavenge effectively and stand-off the applied voltage while the capacitor was recharged during the interpulse period. Pyrex glass was found to perform this function adequately for moderate pulse frequencies. The accelerator is presently operational and entering the performance evaluation phase. Operation at moderate pulse frequencies is routine. Materials for high-pulse frequency operation remain to be identified. (auth)

26810 IMPROVEMENTS IN OR RELATING TO PLASMA ACCELERATORS. Giusto Fonda-Bonardi (to Litton Industries Inc.). British Patent 960,325. June 10, 1964. Filed May 15, 1962.

A closed-path plasma accelerator is designed for use in inducing fusion reactions by the collision of accelerated plasma beams. The accelerator uses a rotating magnetic field to accelerate the plasma along an evacuated curved path, and a second magnetic field is used to balance the centrifugal force of the plasma. A fusion reactor is described which comprises two such accelerators positioned so that their paths intersect to form a reaction region. (D.L.C.)

26811 HIGH ENERGY PLASMA SOURCE. Walter A. Jaatinen, Raymond M. Chappel, and Wilfred R. Cook (to Sheer-Korman Associates, Inc.). U. S. Patent 3,136,915. June 9, 1964. Filed Apr. 19, 1962.

An electric arc configuration is described for producing high-energy plasma radiation. The configuration comprises a central cathode surrounded concentrically by an anode in which openings are provided for passing fluid. The cathode is positioned in front of the anode with a conical terminus end so that the fluid emerging from the anode is caused to undergo a focused discharge. The configuration has generated a peak brightness of 5000 candles/mm^2 at a chamber pressure of 300 psig argon gas and a power input of 14 kw. (D.L.C.)

Shielding

Refer also to abstract 26515.

26812 (AEC-tr-6372(p.11-15)) STUDIES ON THE ENERGY DISSIPATION DISTRIBUTION OF BETA RAYS IN MATTER. III. MEASUREMENTS OF ENERGY DISSIPATION DISTRIBUTION IN HEAVY MATERIAL ELEMENTS USING AN ION CHAMBER. Yota Nakai, Harumi Izura, Koji Matsuda, and Kiichi Kimura. (Translation)

The energy dissipation distribution of beta particles adsorbed by heavy element materials and the relation between the absorption and the atomic number were investigated. The target materials were Ag with Z = 47 and Pb with Z = 82. Well-collimated beta beams with energies of 1.0, 1.2, 1.4, 1.6, and 1.8 Mev were used. The energy dissipation distribution curves showed good agreement with previous results. The ratio between absorption and atomic number decreased in Ag and Pb with increasing atomic weight, indicating that the mean scattering angle of incoming beta particles increases with increasing Z. (P.C.H.)

26813 (AEC-tr-6372(p.17-28)) MEASUREMENT OF TRANSMISSION OF BETA RAYS THROUGH SEVERAL MATERIALS. Yota Nakai, Harumi Izura, Koji Matsuda, Shigehiro Osuga, and Kiichi Kimura. (Translation)

The transmission of beta particles through Be (Z = 4), Al (A = 13), and Ag (A = 47) was measured, along with backscattering, using a Faraday chamber. In the scope of the transmission curves and materials studied, the extrapolated range approaches the true range, the smaller the atomic number of the absorber and the higher the energy of the beta particle becomes. Data on backscattering are tabulated. (P.C.H.)

26814 (ORNL-tr-80) BUILD-UP FACTORS. COEFFICIENTS OF THE J. J. TAYLOR EQUATION. S. Buscaglione and R. Manzini (Italy. Comitato Nazionale per l'Energia Nucleare, Bologna). Translated for Oak Ridge National Lab., Tenn., from report CEC-85. 19p.

The coefficients for the buildup factors expressed on the basis of the J. J. Taylor equation (NSA 10: 5001) were determined for some of the most common materials for the construction of gamma shielding. The materials investigated were H_2O, Al, Fe, Pb, Sn, W, U as well as normal concrete, barite concrete, ferrophosphorus concrete, and magnetite concrete. (auth)

26815 PROTECTION AGAINST SOLAR FLARE PROTONS. Trutz Foelsche (National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.). Advan. Astronaut. Sci., 8: 357-74(1962).

Mass shielding requirements are estimated for flight during extreme flare-proton events in the distance environment of the earth. Chosen as examples for calculation of doses behind different amounts of shielding are the high-energy event on February 23, 1956, the low-energy extreme flux events from May 10 and July, 1959, and the high-flux event of August 22, 1958. Estimates are based on the spectra and their variations given by J. R. Winckler, D. K. Bailey, K. A. Anderson, R. Arnoldy, R. A. Hoffman, and L. Peterson, on the basis of sea-level, balloon, ionospheric, and space-probe observations during solar proton events. (auth)

26816 NUCLEAR PROBLEMS IN RADIATION SHIELDING IN SPACE. S. P. Shen (State Univ. of New York, Albany and New York Univ., New York). Astronaut. Acta, 9: 211-74(1963).

The fundamental physical problems encountered in the shielding and depth dosimetry of energetic particles in space are reviewed and discussed. This is done by examining the various phenomena accompanying the passage of a charged strongly-interacting particle in a condensed medium. The electromagnetic (i.e., atomic) interactions and their aggregate effect, being comparatively well understood,

are only briefly recalled. The high-energy nuclear interactions and their outcomes are discussed in greater detail, together with their significance for shielding and dosimetry. The roles of the interaction secondaries and the development in the absorbing medium of a chain of nuclear interactions (nuclear cascade) are discussed at length. This is followed by a review of accelerator experiments of relevance to nuclear-cascade studies, employing protons from 0.1 to 25 Gev. The theory of the nuclear cascade is then briefly outlined, as well as current efforts to calculate the cascade. The article concludes with a recapitulation of the astronautical and astrophysical applications of nuclear-cascade studies and of the present state of shielding physics. Items of interest to the nascent field of high-energy depth dosimetry are recapitulated. The diffusion of heavy cosmic rays, the effects of very-high-energy cosmic rays, and induced radioactivities are also discussed. (auth)

26817 ANGULAR DIFFERENTIAL DOSE ALBEDO MEASUREMENTS FOR 0.66-Mev γ's INCIDENT ON CONCRETE, IRON, AND LEAD. C. E. Clifford (Defence Research Chemical Labs., Ottawa). Can. J. Phys., 42: 957-71(May 1964). (DRCL-412A)

The angular dependence of the scattered dose produced by 0.66-Mev γ's incident on concrete, iron, and lead was measured for angles of incidence of 0°, 30°, and 60°. The angular distributions from these materials were dependent both on the angle of incidence and on the angle of scatter to a detector and could not be related to each other by simple multiplicative factors. As the angle of incidence increased, the scattering in the forward directions became increasingly anisotropic for each material. For iron exposed at normal incidence the effect of the scatterer thickness on the angular distribution of the scattered dose was measured also. A Monte Carlo program was used to study the distribution of distances between the point of incidence and the point at which a backscattered γ emerged and indicated that scatter from the shadow zone could be significant in some shielding studies. The program was used also to study the distribution of depths of the point at which a backscattered γ had its last scattering interaction. (auth)

26818 OPTIMUM SHAPE OF SHIELDING BARRIER FOR DISC SOURCE. J. P. Jain and M. M. Gupta (Inst. of Nuclear Medicine and Allied Sciences, Delhi). Health Phys., 10: 337-40(May 1964).

An attempt was made to discuss the optimum shape of a shielding barrier for a disc source. The problem is divided into two parts. In Section A the attenuation of gamma radiation is supposed to be due to the linear absorption only in the shielding material. In Section B the effect of build-up factor on the optimum shape of the shielding barrier is discussed. For calculations, a suitably approximated form of build-up factor for gamma ray is used. One can draw a legitimate conclusion that build-up factor plays a paramount role in optimizing the shape of a shielding barrier. (auth)

26819 PROTECTING COMMUNICATION SYSTEMS FROM EMP EFFECTS OF NUCLEAR EXPLOSIONS. J. B. Hays (Bell Telephone Labs., [Murray Hill, N. J.]). IEEE (Inst. Elec. Electron. Engrs.), Spectrum, 1: 115-22(May 1964).

The protection of communication systems from electromagnetic pulses created by nuclear explosions is discussed. The effects of the electromagnetic pulse and of lightning on a communication system are sufficiently similar so that lightning protection techniques are useful in electromagnetic pulse protection, particularly against the effects of transient currents on cables. Methods of shielding an entire building were suggested. Suggestions were also made concerning the treatment of water pipes and power lines that enter the shielded building to prevent them from introducing unwanted signals. (C.E.S.)

26820 PENETRATION OF GAMMA RAYS IN PARAFFIN. M. S. El-Nesr and K. A. Mahmoud. Proc. Math. Phys. Soc. (U.A.R.), No. 25, 59-65(1961).

The energy spectra of gamma rays from ^{137}Cs, ^{60}Co, and ^{24}Na sources (0.667 to 2.76 Mev) were measured upon emerging from paraffin barriers. The experimental results, obtained with a single-channel gamma spectrometer, were compared with experimental predictions. The investigation indicated that paraffin is a better material than water for protection against the scattered radiation. (D.C.W.)

26821 ENERGY SPECTRUM OF ELECTRONS TRANSMITTED BY UNSUPPORTED METAL FILMS. A. R. Shul'man, I. R. Kanicheva, and B. F. Barzdo (Kalinin Polytechnical Inst., Leningrad). Soviet Phys.-Solid State (English Transl.), 5: 2430-1(May 1964). Translated from Fiz. Tverd. Tela, 5: 3318-21(Nov. 1963).

To determine the contribution of deceleration to the experimentally determined maximum electron range and to obtain qualitative information on the role of absorption in the attenuation of an electron beam, the transmission of electrons and the energy spectra of the emitted electrons were investigated. The investigations were carried out by the retarding potential method in the electron energy range of 0.5–12 kev. The test specimens were free thin Al films (500–7000 Å thick). (C.E.S.)

26822 DISTRIBUTION OF ELECTRON BEAM ENERGY LOSSES WITH DEPTH IN COPPER AND ALUMINUM. A. R. Shul'man, I. R. Kanicheva, and B. F. Barzdo (Kalinin Polytechnical Inst., Leningrad). Soviet Phys.-Solid State (English Transl.), 5: 2452-4(May 1964). Translated from Fiz. Tverd. Tela, 5: 3344-6(Nov. 1963).

The secondary electron emission coefficient was plotted as a function of incident energy from 4 to 15 kev to determine the distribution of electron beam energy losses with depth in copper and aluminum films. (C.E.S.)

26823 CALCULATION OF THE PASSAGE OF FAST ELECTRONS THROUGH MATERIAL BY A COMBINATION OF ANALYTICAL AND STOCHASTIC METHODS. Guenther Meissner (Technische Hochschule, Munich). Z. Naturforsch., 19a: 269-83(Mar. 1964). (In German)

In order to calculate the passage of fast electrons through material under the influence of Coulomb scattering, excitation, and ionization, a Monte Carlo method was developed from a combined analytical and stochastic method of solution. Large energy and pulse changes of the electrons were treated stochastically, small changes analytically. For monoenergetic electrons of 2 m c^2 striking perpendicularly on aluminum foil, the following calculations were carried out on the IBM-7090 and compared with experiments: the energy distributions after transmission of layers 157.5 and 210 mg/cm^2 thick, the dose distribution as a function of the penetration depth in the foil from 210 to 420 mg/cm^2 in the semi-infinitely extended medium, and the corresponding transmission and reflection coefficients to the corresponding depths. (tr-auth)

REACTOR TECHNOLOGY

General

26824 (ANL-6885) REACTOR DEVELOPMENT PROGRAM. Progress Report, April 1964. (Argonne National Lab., Ill.). May 15, 1964. Contract W-31-109-eng-38. 83p.

Summaries are given of: operations and parameters of Borax-V, ZPR-III, ZPR-IX, EBR-I and -II, FARET, High Conversion Critical Experiment, ZPR-VII, Plutonium Recycle Experiment, Argonne Advanced Research Reactor, and TREAT; fuel and fuel element corrosion, development, and mechanical and irradiation testing; neutron physics; mechanical properties of reactor alloys; heat transfer and fluid flow; separation of U and Pu in irradiated fuel elements; reactor safety experiments; chemical compatibility studies for reactor coolants and fuels; coolant chemistry; MHD cell development; and fast and thermal reactor studies. (T.F.H.)

26825 (BAW-1228) STUDY S-R-30—OPEN LOOP ANALOG STUDY. J. F. Hafer and W. E. Carson (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.). Oct. 1961. Contract AT(30-3)-274. 44p.

The open-loop analog study individually simulates the various components that comprise the primary and secondary systems of the Advanced Test Reactor (ATR) Plant. This facilitates the discovery of simulation difficulties and leads to a reduction in simulating equipment. A diagram of the plant functional system is given. Information gained during the open-loop studies and the simulations that will be used in the closed-loop analog analysis are reported. (auth)

26826 THE ROLE OF EXPERIMENTAL REACTOR PHYSICS IN GENERAL ELECTRIC CORE DESIGN PHILOSOPHY. G. T. Petersen, P. G. Aline, and R. J. McWhorter (General Electric Co., San Jose, Calif.). p.209-31 of "Exponential and Critical Experiments. Vol. II." Vienna, International Atomic Energy Agency, 1964.

During the design of the first large central station boiling-water reactor (Dresden) a partial mockup critical experiment was utilized to verify specific design information. As the development of the boiling-water reactor has progressed, the emphasis has shifted from mockup experiments to experiments specifically designed to test the performance of the analytic design models and to the utilization of the extensive data generated in reactor startup programs. For example, GE recently completed a series of critical experiments to study the ability of the existing design methods to predict the effects of various types of control augmentation in advanced boiling-water reactors. At the same time data from startup programs conducted at the GE designed plants (Dresden, Consumers Power, Humboldt Bay, SENN, and JAERI) are also being utilized in the development of new and better physics methods. As new reactor concepts are developed, both basic lattice measurements and mockup measurements in critical assemblies will continue to be utilized to establish the physics parameters of interest before the finalization of the first basically new design. Nuclear superheat is an example of such a concept. The nuclear superheat concepts under active study at GE include both water-moderated and unmoderated core designs. The emphasis on water-moderated designs is placed on the separate superheat-reactor concept, whereas the emphasis on the unmoderated designs is directed toward the integral boiling-water unmoderated fast-spectrum superheat-reactor concept. The water-moderated separate superheat concept was carried through the critical experiment stage to the prototype. The prototype, the ESADA Vallecitos Experimental Superheat Reactor, was scheduled for criticality in July 1963. The integral boiling-water unmoderated fast-spectrum superheat-reactor concept is currently entering the critical experiment stage at GE under the AEC sponsored mixed-spectrum Superheat-Reactor Program. In the execution of the experimental reactor physics measurements GE relied primarily on the utilization of critical experiments. However, recent developments in the application of pulsed-neutron techniques have led to increased utilization of subcritical measurements. GE has developed a pulsed-neutron technique that yields the shut-down reactivity in dollars $(1 - k)/k\beta$ directly. GE has also developed several other experimental techniques that have proven very effective. Two examples are: a novel method of measuring the ^{238}U conversion ratio, and resonance-foil activation techniques to determine neutron spectral information. (auth)

26827 THE RELATION BETWEEN EXPERIMENT AND THEORY IN REACTOR PHYSICS. C. G. Campbell, G. H. Kinchin, and R. D. Smith (Atomic Energy Establishment, Winfrith, Eng.). p.29-46 of "Exponential and Critical Experiments. Vol. I." Vienna, International Atomic Energy Agency, 1964.

The end-product of theoretical and experimental reactor physics work is a detailed knowledge of the neutron physics behavior of a power reactor, including the reactivity, power distribution, and control characteristics. The problem may be divided into two parts. First, the properties of simple geometric configurations of homogeneous or uniform lattice structure, and secondly, the effects of departures from the idealized system, including the effects of control rods and other absorbers. Alternative approaches to the first problem are possible. For instance, an approximate physical model can be used and experiments carried out covering a range of all the variables. The experiments are then correlated using the simple model and adjusting the nuclear data to give agreement. This approach has been used successfully for natural uranium-fueled graphite-moderated reactors but is difficult to apply to enriched thermal reactors particularly if more than one fissile material is to be considered. Similarly, for fast reactors good agreement, at least for the smaller systems with relatively hard spectra, can be obtained by "one group" calculations in which all neutrons are assumed to have an energy that is associated with a single effective cross section. The other extreme is to use basic nuclear data and the best physical model that can be conceived with present-day knowledge. Such an approach is made possible by the increased capacity of digital computing machines and by our improved knowledge of nuclear data. The calculations are required to predict the precise physical quantities measured in the experiments. This approach has been used in the liquid-moderated reactor field where the experiments are compared with the most elaborate theory and with a theoretical model sufficiently detailed to account for the physical processes involved using basic data, yet adequately rapid in application to be a useful method for design survey purposes. Similar approaches are possible for lattice irregu-

larities. The relative merits of making measurements in subcritical and critical systems are discussed indicating those experiments for which a critical reactor is required. The discussion embraces graphite, heavy- and light-water thermal reactors, and fast reactors. (auth)

26828 ASPECTS OF REACTOR PHYSICS RESEARCH AT THE VICTORIA UNIVERSITY OF MANCHESTER. M. J. Harris and D. G. Walton (Victoria Univ., Manchester, Eng.). p.371-401 of "Exponential and Critical Experiments. Vol. I." Vienna, International Atomic Energy Agency, 1964.

A survey of the work to date on accelerator-driven, natural uranium, light-water exponential piles, discussion of the results obtained, outlines of proposed future work, and descriptions of various low-cost, labor-saving experimental techniques that were adopted are presented. Neutron diffusion in light water was studied using both pulsed source and steady source methods. In the former method full harmonic is stressed analysis to the extent of actually studying the higher modes as opposed to most former work, which has tried only to eliminate them. In the study of steady source methods all effects from finite source and detector size, resonance activation, flux perturbation, and so on were eliminated. The results of both are discussed and compared. A very careful measurement of absorption cross sections by the pulsed technique, taking care to eliminate harmonic and other effects likely to lead to error is also in progress and is described. Thermal neutron spectra in "poisoned" light water are being measured as a means of investigating and developing integral detector techniques. This discussion includes some interesting time- and cost-saving examples. Large foil activation and counting techniques for measuring spatially averaged neutron densities, and hence a number of reactor parameters, were studied. Some interesting points have arisen particularly with regard to spectrum measurement. The method makes possible many reactor physics investigations with limited resources. A low-cost natural uranium, light-water exponential was constructed. Its mechanical design gives considerable flexibility so that, for instance, measurements parallel and perpendicular to the fuel rods are greatly facilitated. A program of steady-state measurements is under way. Future work is outlined, and includes fine structure measurements, voidage effects and pulsed-neutron studies. (auth)

26829 SODIUM COMPONENTS IN NUCLEAR REACTOR SYSTEMS. J. J. Morabito (Atomic Power Development Associates, Inc., Detroit). 21p. (CONF-504-6)

From American Power Conference 26th Annual Meeting, Chicago, Apr. 1964.

The development of sodium components for use in nuclear reactor systems is reviewed. Present experience accumulated on sodium components indicates that difficulties in early operation can be expected since the technology is still new. However, once early difficulties are corrected, experience indicates that sodium components should have long life and high reliability. The use of sodium in reactor vessels and associated equipment, intermediate heat exchangers, steam generators, and pumps is discussed. (P.C.H.)

Auxiliaries and Components

26830 (AEEW-M-369) A PRELIMINARY STUDY OF THE CHARACTERISTICS OF MINERAL INSULATED CABLES FOR REACTOR CONTROL PULSE COUNTING CHANNELS. R. W. Levell (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Sept. 1963. 29p.

The screening and transmission properties of some mineral-insulated cables are investigated over the frequency range 10 kc/s to 100 Mc/s for temperatures up to 400°C. (auth)

26831 CALCULATION OF THE EFFECTIVENESS OF MULTILAYER CONTROL RODS. E. I. Grishanin. At. Energ. (USSR), 16: 234-8(Mar. 1964). (In Russian)

When calculating the effectiveness of control rods, the method of the effective boundary conditions is usually employed by assigning the value of the logarithmic derivative of the neutron flux to the surface and using the diffusion approximation method for defining the conditions outside of the rod. A computation method was derived for calculating the effective boundary conditions of cylindrical multilayer control rods, taking into account the effect of the steel cladding. It was found that the neutron absorption probability of this type of rods must be also considered. Two assumptions must be made to determine this probability: the angular distribution of the neutrons does not change, even when the neutrons cross repeatedly the interfaces separating the layers of the rod; and the influence of the scattering in the individual layers of the rod must be estimated by using the approximation method. The influence of the rod channels, which stay in the reactor after the rods are withdrawn, must also be calculated. As an example, the dependence of the absorption probability of a 2.35-cm diameter B carbide rod on the thickness of the steel cladding and the energy of the incident neutrons was plotted in lethargy units. (TTT)

26832 CALCULATION OF THE EFFECTIVENESS OF CONTROL RODS CONTAINING A MODERATING MATERIAL. E. I. Grishanin and E. V. Pugacheva. At. Energ. (USSR), 16: 238-44(Mar. 1964). (In Russian)

Calculation of the effectiveness of control rods by the effective boundary condition method is usually limited to homogeneous rods having a definite geometric shape. Even calculation methods, which take the effect of cladding materials into account, do not always give a complete answer because often a coolant, such as water, possessing moderating properties, is used in the system. A method was therefore developed for calculating the effective boundary conditions at the surface of the rod by determining its absorption probability. The albedo of a homogeneous rod containing a moderator was determined by the successive collision method, using approximation computation for the solution of the derived equations. The albedo was thereby defined as the ratio of the neutrons escaping from the rod to the number of neutrons of the same energy falling on the rod from the reactor. The value thus obtained may be used for determining the effective boundary conditions as is done in the case of monoenergetic neutrons. The cases of B carbide rods containing Zr hydride or filled with water were used as illustration. (TTT)

26833 EFFICIENCY OF MULTIPLE CONTROL RODS PARTIALLY INSERTED INTO THE REFLECTED REACTOR. PART II. Fumio Amano. Denki Shikensho Iho, 27: 823-36(Nov. 1963). (In Japanese)

A method for calculating the efficiency of an eccentric control rod, a concentric ring of control rods, and two concentric rings of control rods, and that of calculating the flux distribution in the vicinity of them, when they are partially inserted into the reflector reactor, are described. According to the results of calculating the effect of a concentric ring of control rods, it was confirmed that the par-

tial insertion is much different from the full insertion in the interference effect such as the shadowing or anti-shadowing, and that, owing to the interference effect, the relative reactivity to the full insertion in the case of a concentric ring of control rods is much smaller than the one in the case of a single control rod. In all the examples of calculation, the computation time per case was less than two hours on the computer, ETL Mark V. (auth)

26834 A DIGITAL POSITION INDICATOR FOR CONTROL RODS. L. Parodi and M. Vallauri (Fiat, Sezione Energia Nucleare, Turin). Kerntechnik, 6: 146-54(Apr. 1964).

The indicator was developed to give information on the position of nuclear reactor control rods driven within a sealed container. One use was in a control rod drive mechanism prototype of the "magnetic jack" type made for the organic moderated reactor PRO, designed by CNEN. The design and operation principles of the indicator are described together with its practical realization. The performance characteristics are also discussed on the basis of operation results obtained during tests on the first unit. (auth)

26835 TUBULAR GUIDE AND HEAT-INSULATOR UNIT FOR NUCLEAR REACTORS. Roger Caillat, Jean Elston, and Jean Rapeneau (to Commissariat à l'Energie Authority). British Patent 957,707. May 13, 1964. Priority date Apr. 26, 1962, France.

A tubular unit is designed for heat insulation of a pressure tube in liquid-moderated reactors. The unit exhibits a heat conductivity coefficient which is low in the radial direction and higher in the axial direction, thereby eliminating hot spots. The unit comprises a guide tube and a tube made of pyrographite with the crystallite senary axis oriented perpendicularly to the duct aixs. The guide tube may be made of fritted magnesium containing some magnesia. Other possible variations of the unit are described. (D.L.C.)

26836 IMPROVEMENTS RELATING TO THERMAL NUCLEAR REACTORS. Kenneth Prince and Norman Prince (to United Kingdom Atomic Energy Authority). British Patent 957,786. May 13, 1964. Filed Dec. 16, 1960.

A graphite moderator structure is designed for reduced stresses in the graphite blocks due to differing temperatures in the restraint cage and charge face. The structure comprises interlocked graphite blocks assembled into a moderator mass, a restraint cage fixedly connected to the peripheral blocks of the mass, and a charge face at one end of the mass composed of a number of separate plates whose apertures register with the fuel element channels. The plates are separated from each other by gaps and are interconnected by means of sliding keys. (D.L.C.)

26837 IMPROVEMENTS IN OR RELATING TO NEUTRON SHIELDING. Donald Wilfred Lawson (to United Kingdom Atomic Energy Authority). British Patent 957,814. May 13, 1964. Filed Mar. 20, 1962.

A neutron scatter plug for a reactor shield is designed which allows coolant flow therethrough but which has a reduced tendency to rotate due to the flow. The plug comprises an elongated body with helical ribs and flow deflectors. The plug is similar to that described in British Patent 897,446 and is designed for the steam-generating heavy water-moderated reactor type described in British Patent 897,457. (D.L.C.)

26838 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Ronald Scott Challender (to United Kingdom Atomic Energy Authority). British Patent 957,815. May 13, 1964. Filed Mar. 21, 1962.

An apparatus is designed for replacing the impeller in a gas-cooled reactor of the kind in which at least one heat exchanger by at least one blower and an impeller of the blower is disposed within the pressure vessel. The apparatus comprises a shielded flask with an aperture, a support platform rotatable in the flask and with an impeller on each side, means for sealing the flask with its aperture in register with an aperture in the pressure vessel, means for purging the flask, and means on the support platform for raising and lowering an impeller through the apertures. (D.L.C.)

26839 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Jane Cicely Thompson and William Macrae (to Nuclear Power Plant Co. Ltd. and AEI-John Thompson Nuclear Energy Co. Ltd.). British Patent 958,011. May 13, 1964. Filed July 2, 1962.

A loading and unloading system is designed for gas-cooled graphite-moderated reactors. The system comprises standpipes passing through the pressure vessel, tubular members extending from the standpipes, and a plurality of tubular extensions extending from each tubular member into several channels in the core. Apertures are provided in the members or extensions for the outlet of coolant from the channels. A charging chute is provided for each set of extensions of a member. During reactor operation except when it is being used for loading or unloading fuel, each tubular member has a thermocouple-instrumented and valved pipe for sampling the coolant and conveying the samples to fission product detection means. (D.L.C.)

26840 IMPROVEMENTS IN OR RELATING TO PRESSURIZED NUCLEAR REACTORS. David Dutton and John Oliver Cowburn (to United Kingdom Atomic Energy Authority). British Patent 958,439. May 21, 1964. Filed May 30, 1962.

A cover is designed for conducting thermocouple cables through the wall of a reactor pressure vessel. Seals are provided for each side of the cover, and means is provided for testing each seal. (D.L.C.)

26841 IMPROVEMENTS RELATING TO THE COMPENSATION OF WIGNER GROWTH IN NUCLEAR REACTORS. Eric Victor Lockney (to Head Wrightson and Co. Ltd.). British Patent 958,650. May 21, 1964. Filed Aug. 28, 1959.

A reactor core structure built of graphite block columns is designed to minimize the effects of Wigner growth. In the structure, a tile arrangement is used in which two tile types alternate with each other. One tile type is double the thickness of the other and is arranged with its extrusion axis in the vertical direction, while the tiles of single thickness are arranged in pairs with their extrusion axes horizontal and at right angles to each other. (D.L.C.)

26842 SUPPORT STRUCTURE FOR VERTICAL STACK OF SOLID MODERATOR. Gerard Dupuy (to Commissariat à l'Energie Atomique). British Patent 958,887. May 27, 1964. Priority date May 25, 1962, France.

A support structure for a vertical moderator stack in a gas-cooled heterogeneous reactor is designed which keeps the lattice pitch of the moderator columns constant in spite of deformations of the structure. The support structure comprises an assembly of adjacent polygonal tiles separated by a lateral clearance, each tile being adapted to support an assembly of say seven moderator columns. Each

tile is coupled only to the central column of the column assembly by means of a spigot. (D.L.C.)

26843 FUEL ELEMENT LOADING AND UNLOADING DEVICE FOR NUCLEAR REACTOR. Lucien Coffin and Camille Lefeuvre (to Electricite de France (Service National)). British Patent 958,921. May 27, 1964. Priority date Nov. 15, 1961, France.

A charge chute is designed for the charging and discharging of a gas cooled reactor. The chute comprises an axial tube for insertion into a standpipe, an oscillating tube adapted to be brought opposite to any one of the channels being served by the standpipe, and a pivoted strut extending between the oscillating tube and an axially movable member. The operation of the chute is described. (D.L.C.)

26844 IMPROVEMENTS RELATING TO GRAB DEVICES. Bruno Reiter (to English Electric Co. Ltd.). British Patent 958,954. May 27, 1964. Filed Oct. 6, 1959.

A grab device is designed for raising and lowering a fuel element or other component in a reactor channel. The device comprises a carrier member for connection with hoisting means, a number of hook members pivoted on the carrier for engaging the component, a releasing member coupled to the hook members, and a plurality of remotely operated solenoids for moving the releasing member. Both the carrier and releasing members are hollow and cylindrical, and part of the component is carried inside the hollow interior of the device. (D.L.C.)

26845 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. (to Escher Wyss AG). British Patent 959,383. June 3, 1964. Priority date Sept. 19, 1959, Switzerland.

A device for regulating a reactor is designed which influences the neutron flux distribution in a uniform manner. The device comprises at least one pair of neutron-absorbing control elements for insertion into the reactor, in which the elements of each pair are arranged on opposite sides of the reactor and are coupled together so that, on operation of the regulating device, they move simultaneously by the same distance in opposite directions to each other. (D.L.C.)

26846 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTOR FUEL LOADING ARRANGEMENTS. Robin Arthur Underwood and Ian Laird McKenzie Paterson (to C. A. Parsons and Co. Ltd.). British Patent 959,599. June 3, 1964. Filed May 2, 1961.

A device is designed for supporting a string of fuel elements while they are being loaded into a reactor channel The device comprises a jig enclosing the fuel elements which are supported by a latch mechanism at the lower end thereof. The latch mechanism is arranged to be released when the fuel elements come to rest in the channel at the end of the lowering operation. (D.L.C.)

26847 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTOR FUELLING ARRANGEMENTS. George Michael Emsley, John Albert Robinson, and John Burdett (to Nuclear Power Plant Co. Ltd. and AEI-John Thompson Nuclear Energy Co. Ltd.). British Patent 959,852. June 3, 1964. Filed Jan. 23, 1963.

A loading jig is designed for supporting a number of fuel elements placed end to end while they are loaded into a reactor channel. The jig comprises a lifting head located at one end of the fuel element assembly, a release unit located at the other end, and rods extending between the lifting head and the release unit. The release unit has a spring-actuated plunger adapted to release the jig from the fuel elements on contact with the fuel element support. A shroud is used to prevent accidental jig release. (D.L.C.

26848 IMPROVEMENT IN AND RELATING TO NUCLEAR REACTOR CORES. John Oliver and John Austin Incledon Blair (to the Nuclear Power Plant Co. Ltd. and AEI-John Thompson Nuclear Energy Co. Ltd.). British Patent 960,019. June 10, 1964. Filed Jan. 23, 1962.

A sealing means is designed for reducing coolant leakage between adjacent blocks in a column in a solid reactor core structure. The sealing means comprises a metal sealing ring located in a recess formed between opposed end faces of adjacent blocks. Several embodiments of the block-sealing ring arrangement are described. (D.L.C.)

26849 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Robert Arthur Smith (to Rolls Royce and Associates Ltd.). British Patent 960,170. June 10, 1964. Filed June 29, 1961.

A control rod for reactivity control is designed which may be positioned accurately during normal operation but which may be caused to drop into the reactor under scram conditions. The rod has a feed means including a lead screw coupled to the rod through electromagnetic means which on de-energization releases the rod. The lead screw engages a nut device which is located against movement in the direction of the lead screw length and which is rotatable by a vernier motor for accurate control of the rod. (D.L.C.)

26850 IMPROVEMENTS IN OR RELATING TO CONTROL ROD DRIVE MECHANISMS FOR NUCLEAR REACTORS. (to General Dynamics Corp.). British Patent 960,673. June 10, 1964. Priority date Aug. 23, 1961, United States.

A control rod drive is designed which uses pressure fluid to emergency trip control rods to their fully inserted positions in the reactor core. The drive comprises a lead screw for connection with a control rod, a fluid-operated motor connected to the screw, an electric motor, a clutch means for releasably connecting the electric motor to the screw for normal regulation of the reactor, and means for supplying pressure fluid to the fluid motor to disconnect the electric motor from the screw and to rapidly drive the control rod into the reactor core. (D.L.C.)

26851 ELECTROHYDRAULIC DRIVE FOR NUCLEAR REACTORS. Hermann Kumpf (to Siemens-Schuckertwerke AG). German Patent 1,162,006. Jan. 30, 1964. Filed July 17, 1959.

A drive is provided in which the advantages of the hydraulic type for shut-down operations are combined with those of the magnetic jack for fine control. The control rods are attached to a piston that is axially displaceable within an elongated tubular housing mounted on the reactor vessel and extending to the interior of the core. The reactor coolant medium serving as the hydraulic driving medium for the piston, the housing is provided with bores or passages that connect the inside of the housing directly with the inside of the reactor vessel. The piston is only loosely fitted into the housing so that jamming of the rods in case of distortions is avoided. (Gmelin Inst.)

26852 TENSION DEVICE FOR THE MODERATOR STRUCTURE OF A NUCLEAR REACTOR. John David Dell (to Babcock and Wilcox-Dampfkesselwerke AG). German Patent 1,163,464. Feb. 20, 1964. Priority date June 3, 1959, Great Britain.

A linkwork assembly is given for applying external support to the core of a nuclear reactor which consists of vertically arranged moderator columns. A plurality of link members is disposed end to end in a ring-like manner so as, when the assembly is in position around the structure, to encircle the structure and have radial clearance

therefrom. The link members are pivotally connected with each other. The tension is generated by tension rods and pressing rods arranged in parallel which are connected to radially arranged angle levers. An essential feature of the invention is that the tension and pressing rods are made of a material of different expansion coefficients, so that a very good temperature compensation is achieved. (Gmelin Inst.)

26853 REACTOR WITH A PRESSURE VESSEL. Arno Mueller (to Deutsche Babcock and Wilcox- Dampfkessel-Werke AG). German Patent 1,163,466. Feb. 20, 1964. Filed July 18, 1961.

The reactor plant described has a pressure vessel that is divided into two chambers by a partition wall; the main chamber containing the core and heat exchanger separated by shielding. The partition wall is provided with openings to facilitate pressure exchange between the two chambers. Located within the secondary chamber are coolers, drive motors for the blowers of the primary coolant medium, subsidiary blowers for cooling the drive motors, and emergency blowers, e.g, for the removal of after-glow heat. (Gmelin Inst.)

26854 CHARGING MACHINE FOR GAS OR LIQUID COOLED NUCLEAR REACTORS. Hermann Kumpf (to Siemens-Schuckertwerke AG). German Patent 1,165,171. Mar. 12, 1964. Filed Apr. 29, 1961.

The charging machine comprises a drum magazine, a separate cooling arrangement with a pump or a blower, and a channel within the lower portion of the machine for guiding the fuel elements. An essential feature of the invention is that a cooling arrangement is given that avoids the penetration of hot coolant medium from the reactor into the machine, so that all parts of the machine have substantially the same temperature. (Gmelin Inst.)

26855 TRANSFER MECHANISM. David Nicoll and Mitchell E. Timin (to U. S. Atomic Energy Commission). U. S. Patent 3,136,432. June 9, 1964.

A transfer mechanism is designed which is particularly adapted for fuel elements and other core components in a nuclear reactor. The mechanism includes a grappler body permitting vertical swinging movement relative to a supporting radius rod with means provided for indexing of the grappler body about a vertical axis while maintaining grappler hooks in fixed relation to the axis. Means are provided for holding down adjacent elements while engaging and lifting a selected element as well as for compensating for minor positioning variations and the like. (AEC)

26856 IMPROVED SERVO-CONTROLLED REGULATOR FOR NEUTRONIC REACTORS. E. R. Mann (to U. S. Atomic Energy Commission). U. S. Patent 3,136,698. June 9, 1964.

A plurality of control circuits for controlling the operation of the regulating rod or rods of a neutronic reactor is designed wherein simultaneous energization of at least two control circuits is required to accomplish operation. (AEC)

26857 IMPROVED FUEL CHANNEL ELEMENTS FOR CIRCULATING FUEL NEUTRONIC REACTORS. Heinz F. Poppendiek and Norman D. Greene (to U. S. Atomic Energy Commission). U. S. Patent 3,136,700. June 9, 1964.

Improved fuel channel element structures are designed for use fn the fuel channels traversing the core of a circulating fuel nuclear reactor. Vane elements are provided in the entrance region of the fuel element having a curvature effective to impart a vortical or tangential velocity component in the fuel flowing in said channel in such a way that the profile of the axial fluid velocity component approximates the volumetric heat production profile or other desired distribution. Exit elements providing a similar flow pattern with pump means and a heat exchanger may be included. More uniform temperatures, improved heat transfer, higher exit temperatures, and other benefits are obtained. (AEC)

26858 DEVICE FOR SHUTTING DOWN OF NUCLEAR REACTORS. William Joseph Sidebottom and Leslie Maurice Fletcher (to United Kingdom Atomic Energy Authority). U. S. Patent 3,136,701. June 9, 1964. Priority date Apr. 17, 1959. Great Britain.

An emergency shutdown device using neutron-absorbing balls is designed for gas-cooled reactors. The device comprises a tube adapted to engage a channel in the reactor core, the tube having its lower end normally closed and containing a baffle which leaves an annular space in the tube for receiving the balls from a magazine located above the tube. Because of the baffle, less time is taken to fill the tube with balls. After operation of the device, the tube may be withdrawn from the core by a refueling machine and its lower end opened for recovering the balls. (D.L.C.)

26859 MONITORING DEVICES FOR DETECTING FISSION PRODUCTS IN A GASEOUS STREAM. Jean Graftieaux and Rene Donguy (to Commissariat à l'Energie Atomique). U. S. Patent 3,136,891. June 9, 1964. Priority date May 19, 1959, France.

A monitoring device is designed for detecting and measuring short-lived fission products from possible fuel can bursts in gas-cooled reactors. The device is an improvement of that described in U. S. Patent 3,084,252, in which the gaseous stream is first passed through a decay zone and then through a collecting zone, whereby the radioactive solid positive ions are collected onto an area of a rotatable drum, and the drum is rotated to bring the area into proximity with a detector. The drum is designed to fit closely within its casing to minimize free volume, and the drum is rotated by a magnetic coupling or driving mechanism through a gastight partition in the casing. (D.L.C.)

26860 NUCLEAR REACTOR FUEL HANDLING SYSTEM. David Nicoll and Jackson L. Hedgecock (to U. S. Atomic Energy Commission). U. S. Patent 3,137,397. June 16, 1964.

A charge machine is designed for manipulating fuel elements in a nuclear reactor. The device includes a movable housing in which is located a vertically movable grapple supported by power driven flexible tape members and which housing can be connected in gas-tight re'ation with a reactor, pickup cell, etc., for manipulating fuel elements and the like. The grappler jaws are actuated by a plunger which is in turn motivated by a power driven flexible tape member. (AEC)

26861 NUCLEAR REACTOR OPERATION. Wyatt B. Silker (to U. S. Atomic Energy Commission). U. S. Patent 3,137,634. June 16, 1964.

A method of operating a nuclear reactor is described whereby the amounts of radioisotopes in the effluent coolant water are reduced. A hydrolyzable aluminum compound is added to the incoming water in amounts greater than required to remove particulate matter, whereby precursors of the radioisotopes are entrapped in the floc resulting from the hydrolysis of the aluminum compound. (AEC)

26862 NUCLEAR REACTOR HAVING TRANSFER MECHANISM. Peter Fortescue and David Nicholl (to U. S. Atomic Energy Commission). U. S. Patent 3,138,535. June 23, 1964.

A reactor, e.g., of the pressurized gas cooled type has a transfer mechanism disposed in a housing located above the reactor vessel and in which is situated a retractable grappler operating through a single centrally positioned opening. The grappler includes pivotally supported paired members supporting a grappler head adapted to engage and raise or lower fuel elements and the like into core passages and/or into a transfer passage into a sealable transfer means. (AEC)

Criticality Studies

26863 (CVNA-134) POWER DISTRIBUTIONS AND CONTROL ROD WORTHS IN A TWO-REGION CLUSTERED UO_2-D_2O LATTICE. H. C. Hecker, J. Jedruch, G. N. Hamilton, and J. A. Roll (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Sept. 1963. Contract AT(30-1)-2289. 199p.

A description is given of the Carolinas–Virginia Tube Reactor Critical experiment and analyses dealing with power distribution and control rod worths. Cores considered were moderated with D_2O and loaded in two concentric zones of 1.1 wt % and 2.0 wt % enriched fuel in the form of either 84 or 72 clusters of 19 rods of UO_2 each, clad in aluminum. Measured power distributions within the fuel clusters are compared to calculations by transport theory. Power sharing between fuel clusters in the core is compared to calculations by diffusion theory. Methods for calculating diffusion theory constants for a cluster unit cell and control regions are summarized. Calculated control rod worths of rods of different composition and construction are compared with experiment. (auth)

26864 (EUR-548.f) ARRÊT D'UN RÉACTEUR A EAU LOURDE PAR VARIATION BRUSQUE DE RÉACTIVITÉ. (Shutdown of a Heavy Water Reactor by a Sudden Reactivity Variation). M. Godelle (European Atomic Energy Community. Joint Nuclear Research Center, Ispra, Italy). 1964. 32p.

The system of kinetic equations for a nuclear reactor is generally not susceptible to integration. A particular case where integration is, however, possible is that of a sudden variation of reactivity, because, this introduced reactivity being constant, the system of kinetic equations becomes linear. The solution, if it is then possible, is in fact very long and tedious since in the case of a heavy-water moderated reactor, a system of 16 linear differential equations is obtained. Nevertheless the results are often necessary, notably when a reactor has to the re-started, if it is desired to estimate the power at criticality on the basis of the residual power. As a rule use is made solely of an empirical formula or, at the best, of the results obtained from the analog computation, though this cannot easily be extended over six decades. The present report fixes the results obtained with the aid of a digital computer. For each of the 15 delayed neutron groups, the numerical tables are drawn up with the following reactivity-variation value: +1000, +100, −1, −10, −100, −1000, −10,000, −333,333 cpm, as well as the corresponding curves. A curve gives, to within a known constant factor, the residual power of a heavy-water reactor from 0.1 second to 3 months after the dropping of the control rods. (auth)

26865 (AEC-tr-6227/1(p.47-9)) PROPOSAL FOR A NEW METHOD OF REACTOR NEUTRON FLUX DISTRIBUTION DETERMINATION. R. V. Popić. Translated from Bull. Boris Kidrich Inst. Nucl. Sci., 15: No. 1, 47-9(1964).

A method, based on the measurement of the activity produced in a medium flowing with variable velocity through a reactor, for the determination of the neutron flux distribution inside a reactor is considered theoretically. (auth)

26866 THE INTEGRAL EQUATION WITH A DIFFUSION KERNEL. 4. SOME NUMERICAL RESULTS. Binkow Sha. Meiji Daigaku Nogakubu Kenkyu Hokoku, 15: 61-2 (Mar. 1963). (In Japanese)

The critical sizes of three typical reactors are calculated numerically in the case of $\alpha^0 = 1$. Reasonable results were obtained by these calculations. Especially, in the case of spherical reactor, the value of β^0/α^0 shows a good agreement with that solved by the transport equation which is considered as a more exact theory. (auth)

26867 ABOUT THE INTEGRAL EQUATION WITH A TRANSPORT KERNEL. 1. THE CASE OF INFINITE SLAB REACTOR. Binkow Sha. Meiji Daigaku Nogakubu Kenkyu Hokoku, 15: 63-5(Mar. 1963). (In Japanese)

It is very difficult to get eigenvalues and eigenfunctions of the so-called transport kernel in the case of arbitrary form of a reactor in an analytical form. In some special cases, however, it is possible to get the eigenvalues by some special mathematical methods. For example, the operational method is successfully applied in the case of an infinite slab reactor. The procedure followed and numerical results obtained are shown. (auth)

26868 ANALYSIS OF DOPPLER-LIMITED POWER EXCURSIONS IN A WATER-MODERATED OXIDE CORE. A. H. Spano (Phillips Petroleum Co., Idaho Falls, Idaho). Nucl. Sci. Eng., 19: 172-86(June 1964).

A calculational model for the Doppler reactivity feedback in a thermal, low-enrichment oxide core with non-uniform temperature distribution is derived on the basis of the UO_2 resonance integral varying as the square root of the absolute temperature. An analytical solution of the prompt-approximation, space-independent neutron kinetic equation, with the Doppler feedback written as a function of the fission energy, is obtained and application made to the self-limiting power-excursion tests conducted in the SPERT I oxide core. Comparison of the experimental and calculated Doppler effects, peak powers, burst energies, and burst shapes is made for various published values of the UO_2 resonance integral temperature coefficient, which acts as a scaling factor in the calculations. The values used cover a spread of about 20% of the mean value, and excellent agreement with experiment is obtained for the smallest values of the coefficient. Systematic agreement is obtained between the calculated and experimental Doppler effects over the entire experimental range of adiabatic fuel-temperature rises attained in the short-period SPERT tests. This agreement implies the validity of a square-root temperature dependence for the Doppler effect in a thermal oxide core, in contrast with a logarithmic or a $T^{1/4}$ dependence, for which similar calculations give results that differ significantly from the experimental data. (auth)

26869 ECCENTRIC POINT SOURCE IN A SPHERICAL REACTOR. A. I. Martin (Nuclear Power Group, Knutsford, Cheshire, Eng.). Nucl. Sci. Eng., 19: 187-8(June 1964).

By use of a certain addition formula, the flux due to an eccentric point source in a spherical reactor is expressed as a single infinite series of known tabulated functions. The change in buckling due to a small point sink is examined together with the shape of such a sink. (auth)

26870 A VARIATIONAL PRINCIPLE FOR HETEROGENEOUS RESONANCE CAPTURE AS A BASIS FOR APPROXIMATION METHODS. Paul F. Gast (General Electric Co., Richland, Wash.). Nucl. Sci. Eng., 19: 196-202(June 1964). (HW-SA-3059)

A variational principle for resonance capture in heterogeneous reactors was developed. The functional becomes the exact resonance integral when the flux is exact, and in general the functional also has the convenient form of an explicit resonance integral multiplied by a correction factor. A reasonable trial function for the adjoint is selected, which allows explicit, interpretable expressions to be derived for the correction factor when trial functions corresponding to the various currently used approximations are inserted. When solutions of Chernick-Rothenstein type equations are used for trial functions, the correction factor is unity. The inexactness of these equations is detectable only with higher-order approximations to the adjoint function. The correction factor for other approximations then furnishes a measure of the error as compared to exact solutions of C-R equations as a standard. Several applications are discussed. (auth)

26871 STUDIES OF NEUTRON THERMALIZATION IN H_2O BY THE PULSED SOURCE AND "NON $\frac{1}{V}$" ABSORBERS METHOD. E. Friedman (Hebrew Univ., Jerusalem). Nucl. Sci. Eng., 19: 203-8(June 1964).

A new method for measuring neutron thermalization parameters that was proposed on theoretical grounds is tested experimentally for H_2O. The characteristic thermalization parameters in the present formulation are: $\gamma_{ij} = \int_0^\infty\int_0^\infty dE dE' \frac{E}{T^2} e^{-E/T} \Sigma_s(E \to E') \left[L_i^1\left(\frac{E}{T}\right) - L_i^1\left(\frac{E'}{T}\right)\right] L_j^1\left(\frac{E}{T}\right)$ where $L_i^1\left(\frac{E}{T}\right)$ are Laguerre polynomials of order unity and degree i, and T is the temperature of the system expressed in energy units. The experimental results for H_2O can be described using one parameter. The result is $\gamma_{11} = (0.210 \pm 0.026)\ cm^{-1}$ for 23°C. The value of this parameter as derived from diffusion-cooling measurements lies in the range of 0.4 cm^{-1} to 0.8 cm^{-1}. A possible explanation for this discrepancy is given. The value of γ_{11} as calculated on the basis of Nelkin's model is about four times higher than this result. (auth)

26872 COLLISION PROBABILITIES IN CYLINDRICAL LATTICES. Edwin M. Pennington (Argonne National Lab., Ill.). Nucl. Sci. Eng., 19: 215-20(June 1964).

First-collision probabilities for a regular lattice of cylindrical fuel rods and moderator are calculated using the assumption that neutrons reaching the outer boundary of the unit cell are returned isotropically. Comparisons are made with results using Fukai's exact method and other approximate methods. The collision probabilities are used in calculating thermal-disadvantage factors which are compared with those from discrete-ordinate calculations using various boundary conditions. The treatment is extended to lattices with cladding on the fuel, and average thermal fluxes are compared with those computed by the THERMOS code. Collision probabilities calculated by this method are in rather good agreement with exact values. (auth)

26873 EXPONENTIAL AND CRITICAL EXPERIMENTS. VOL. I. Proceedings of the Symposium held in Amsterdam, Netherlands, 2-6 September 1963. (International Atomic Energy Agency, Vienna). Proceedings Series. Feb. 1964. 483p. (STI/PUB/79(Vol.I)); (CONF-133). $10.00; Sch 210,-; 60s.stg; F.fr. 40,-; DM 35,-(IAEA).

Separate abstracts were prepared for 10 of the 21 papers presented; 11 were previously included in NSA (17: 42220, 42221, 42222, 42224, 42225, 42236, 42238, 42382, 42385, 42386, and 42387). (R.E.U.)

For abstracts of individual papers see: 26521, 26827, 26828, 26874, 26875, 26876, 26877, 26878, 26879, and 26880.

26874 THE FRENCH ATOMIC ENERGY COMMISSION'S PROGRAM OF CRITICAL EXPERIMENTS WITH THERMAL NEUTRONS. D. Breton, Y. Girard, F. Cogne, and R. Naudet (CEN, Saclay, France). p.47-64 of "Exponential and Critical Experiments. Vol. I." Vienna, International Atomic Energy Agency, 1964. (In French)

The French Atomic Energy Commission's main thermal neutron experiments with graphite, heavy water, and light water are described. The outlines of the program are given and the techniques used are described in relation to reactor projects and their consequences for reactor design. The general results and their practical applications are summarized. Construction and operational costs are given. (auth)

26875 MASURCA, A FAST-NEUTRON CRITICAL MOCK-UP: OPERATION AND USES. A. P. Schmitt (CEA-Euratom, Cadarache, France), F. Storrer, G. Vendryes, G. Tavernier, and J. Van Dievoet. p.135-55 of "Exponential and Critical Experiments. Vol. I." Vienna, International Atomic Energy Agency, 1964. (In French)

Under the EURATOM-CEA Association project a fast-neutron critical mock-up, Masurca, is now being built at the Cadarache Nuclear Research Center. The main purpose of this extremely versatile facility is the study of non-moderated, plutonium critical assemblies of large volume and hence having a relatively soft neutron spectrum. The facility must satisfy certain conditions and, in essence, combine great versatility with almost absolute operational safety. The safety problem was dealt with by: (1) Seeking inherent safety: with simulated fuel elements it was possible to obtain a negative reactivity coefficient from the cumulative longitudinal expansion of these elements and a negative Doppler coefficient; (2) Using a set of shim-safety rods that can be placed in a square lattice with spacings of about 30 cm; (3) A pressure vessel containing reserves of argon in case of fire; and (4) Strict administrative supervision. A U–Pu–Fe metallic alloy being chosen as the basic element in the fuel simulation, provision for cooling large-volume critical assemblies must be incorporated in the facility. Sodium, the coolant used in simulated reactors, will be represented by sodium strips clad in stainless steel. The facility is designed as a vertical single-block unit in view of the maximum volume of the cores to be simulated (about 5000 liters). The simulated elements are shaped like a right prism with a square base (except in the case of fuel elements that have a circular base) with a diameter of 12.7 mm and a height of 102 mm. They are placed in tubes having an overall length of about 4 m and square sections whose diameter is 106 mm. These tubes are placed side by side and suspended. Smaller tubes can be placed in the central area of the suspension plate so that smaller cores can be made. A special heating loop can also be placed in the central part of the facility to measure the Doppler coefficient. The workings of the facility are described. Reference is made to the possibility of simulating fast-reactor oxide cores (by using ferrous oxide elements to introduce oxygen) and carbide cores (by using graphite elements). The mixed loading technique, which will have to be used in view of the amounts of plutonium available for such experiments during the present decade, and the techniques

that will be used to determine the basic neutron parameters are discussed. The place of this critical mock-up in the general basic physics research of fast-neutron reactor development is indicated; the experimental means involved include a Harmonie reactor source, to serve in developing measuring techniques and providing data for exponential experiments, and accelerators serving as static and dynamic neutron sources for subcritical experiments with fast neutrons. (auth)

26876 OPERATING EXPERIENCE WITH THE ZERO-ENERGY FAST REACTOR VERA. J. W. Weale, M. H. McTaggart, H. Goodfellow, and W. J. Paterson (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.159-95 of "Exponential and Critical Experiments. Vol. I." Vienna, International Atomic Energy Agency, 1964.

The design of a two-halves zero-energy fast reactor is briefly described, particular emphasis being placed on those features that determine the practicability and precision of reactor physics measurements. The advantages and disadvantages of the design are discussed with reference to the two years' operating experience of the reactor. The following topics are dealt with: the experimental convenience of the lay-out and of the two-halves design; the size and precision of the fuel pieces and the accuracy of location of the fuel elements; the effects of edge irregularities and heterogeneity of structure on the accuracy with which the critical mass of an "ideal" equivalent assembly is determined; reproducibility of the critical condition after dismantling the assembly, or separating the two halves; variation of reactivity with separation of the halves, including effects of asymmetric loading; sensitivity of various counters, neutron source strength, use of an accelerator neutron source; speed of response of safety circuits and consequent restrictions on rate of assembly of the two halves; additional precautions necessary in using plutonium fuel; and notes on the accuracy of measurement of reactivity and on the practical limitations affecting various other reactor physics measurements. (auth)

26877 CONTRIBUTION TO THE THEORY OF EXPONENTIAL EXPERIMENTS WITH FAST NEUTRONS. F. Storrer (CEA-Euratom, Cadarache, France), P. Govaerts, F. Ebersoldt, and M. Stiévenart. p.197-225 of "Exponential and Critical Experiments. Vol. I." Vienna, International Atomic Energy Agency, 1964.

Exponential experiments permit the determination of certain fundamental parameters relating to fast-neutron reactor cores. Even if the composition of the medium studied differs very considerably from that of power reactors, the exponential experiment, which is an integral experiment, makes it possible to compare the results of calculations with the experimental results and draw certain conclusions about the validity of the methods of calculation or the basic data used. From this point of view exponential experiments are in the same class as other integral experiments such as pulsed experiments. If the pulsed experiment is asymptotic in time the exponential experiment is asymptotic in space. In both cases valid measurements can be made only in a zone in which the transients are damped; hence the need to study the decrease in time or space of the various transition modes in relation to that of the fundamental or asymptotic mode. A method similar to that for pulsed experiments is applied to exponential experiments. The propagation of spatial modes, corresponding to the various transverse geometric buckling values but for a given material buckling, is studied in the conventional way. The energy modes corresponding to the various eigenvalues of the material buckling are considered. The propagation of neutrons in the absence of fissions is first studied, and then this study is applied to the neutrons of each generation and the propagation of neutrons determined in a way that takes account of the fissions. Numerical examples are given and the two types of experiment are compared from the point of view of modal purity to obtain criteria that enable us to select the right type of experiment and obtain optimum experimental conditions in each case. (auth)

26878 THE SUBCRITICAL FACILITY PUK. A. Tas and M. Bustraan (Reactor Centrum Nederland, Petten, Netherlands). p.321-36 of "Exponential and Critical Experiments. Vol. I." Vienna, International Atomic Energy Agency, 1964.

A short description is given of the subcritical facility, PUK, which was designed as a complement to the critical facility KRITO. The facility will consist of a clean hexagonal lattice of 3.8% enriched UO_2 fuel rods with outer and inner diameters of 12 and 10 mm, respectively, at a lattice spacing of 15.1 mm, giving a H_2O/UO_2 volume ratio of 1.07. The k_{eff} will be limited to 0.95. It will be possible to split the core into two halves separated by a vertical watergap, the size of which may be varied from 2 to 38 mm. The facility will be placed against the outer reflector of the Argonaut-type reactor, LFR, at the Reactor Centrum Nederland at Petten. For avoiding asymmetries the core will be rotated around its vertical axis. The facility will be used to measure intracell flux distributions and lattice parameters; to measure the effects of watergaps in a lattice and to study methods for preventing flux peaking; and to supply general experimental data for testing calculational techniques. Techniques for measurements of intracell flux distributions in tightly-packed lattices and of power distributions around watergaps are described. Attention is given to the calculation of spatial-dependent thermal neutron spectra by a modified THERMOS code and to the calculation of flux distributions near watergaps. (auth)

26879 STUDY OF THE PHYSICS OF NEUTRON ACTIVE ZONES BY ACTIVE AND PASSIVE SURFACES METHODS. EXPERIMENTAL VERIFICATION BY MEANS OF A SUBCRITICAL ASSEMBLY. C. Mandrin (Université, Lausanne, Switzerland). p.403-43 of "Exponential and Critical Experiments. Vol. I." Vienna, International Atomic Energy Agency, 1964. (In French)

For the purpose of studying a heterogeneous multiplying medium, it is proposed to divide it into a number of homogeneous regions having the diffusion and absorption properties of the pure moderator. The fuel elements, represented by portions of active surfaces of zero thickness, constitute the separation surfaces of these sub-regions. Externally, the system is bounded by passive surfaces devoid of fissionable nuclei. The theory of diffusion involving several groups of neutrons is applied to each subregion, while the productive and absorbing effects of fissionable materials are represented by the conditions on the active surfaces. To apply the method, it is necessary to know certain parameters of the behavior of an active surface in a known flux. The moderator group constants are presumed to be known. It is shown that, theoretically, a single exponential experiment, carried out with a very small number of rods, should suffice to determine these parameters experimentally. The facility used for these experiments is a subcritical assembly; the fuel is uranium oxide enriched to 1.8%; a water moderator is used. Measurements made for a series of different configurations confirm that the parameters sought depend solely on the

nature of the fuel. The results are used to forecast the behavior of a subcritical and a critical lattice. In the first case the calculations are verified directly by experiment; in the second, they are checked by comparison with published results. (auth)

26880 EXPONENTIAL EXPERIMENTS WITH WATER AND NATURAL URANIUM LATTICES. W. K. Mansfield and J. M. Kim (London Univ.). p.457-67 of "Exponential and Critical Experiments. Vol. I." Vienna, International Atomic Energy Agency, 1964.

A report is given of a series of exponential experiments performed on the Queen Mary College subcritical assembly. This assembly consists of a 4½-ft aluminum core tank in which up to 4 tons of aluminum-clad natural uranium in the form of 1.2-in. dia. bars, 43.25-in. long, are supported vertically by a series of lattice plates. Initially a 10-c, Po-Be neutron source (2.5×10^7 n/s) was used to provide the neutron flux, but later measurements were made using a SAMES, 150 kv neutron generator (5×10^9 n/s). Buckling measurements were made for moderator-fuel ratios of 1.73, 2.48, and 3.18 using indium foils, BF_3 counters and ^{235}U fission chambers as detectors. Migration areas were determined for the same ratios of moderator-to-fuel by means of the boron poisoning technique. The novel features of the results were the apparent variation of the material buckling with fuel loading and with the type of detector employed. The reasons for these variations are discussed and their general significance to exponential experiments in hydrogeneous media developed theoretically. (auth)

26881 EXPONENTIAL AND CRITICAL EXPERIMENTS. VOL. II. Proceedings of the Symposium held in Amsterdam, Netherlands, 2-6 September 1963. (International Atomic Energy Agency, Vienna). Proceedings Series. Feb. 1964. 619p. (STI/PUB/79(Vol.II)); CONF-133). $12.00; Sch 252,-; 72s.stg; F.fr 48,-; DM 42,-(IAEA).

Separate abstracts were prepared for 9 of the 26 papers presented; 17 were previously included in NSA (17: 29727, 34718, 38493, 38564, 40262, 42007, 42218, 42226, 42227, 42231, 42232, 42234, 42237, 42383, 42384, 42400; 18: 13236). (R.E.U.)

For abstracts of individual papers see: 26249, 26826, 26882, 26883, 26884, 26885, 26886, 26947, and 26948.

26882 MINOR, A SUBCRITICAL FACILITY FOR HEAVY-WATER LATTICE STUDIES. R. W. Meier, H. R. Lutz, and E. Utzinger (Swiss Federal Inst. for Reactor Research, Würelingen, Switzerland). p.59-83 of "Exponential and Critical Experiments. Vol. II." Vienna, International Atomic Energy Agency, 1964.

The subcritical facility MINOR is an instrument for the investigation of heavy-water-moderated lattices at cold clean conditions. It consists of a bare tank of 140-cm diameter and 280-cm height. Neutrons are fed through a graphite pedestal either from a set of five adjustable Sb–Be sources with a total strength of 10^{11} n/s or from a pulsed accelerator. Flux plots in r- and z-directions are obtained with movable miniature BF_3 counters, positioned remotely according to a preselected program. All information is collected automatically and punched on paper tape. Flux fine structure and spectral data are obtained with Dy and Au foils. The facility, which has been in operation since 1959, was modified considerably during the summer of 1962 and was set up in a new shielded laboratory where it is again operating. Natural uranium, metallic fuel elements of single rods, clusters of rods, and clusters of tubes were investigated systematically. A full description of the facility itself, the experimental techniques used, the experimental programs, and the safety procedures applied are given. (auth)

26883 THE CRITICAL FACILITY KRITO. J. Coehoorn (Reactor Centrum Nederland, The Hague), W. W. Nijs, et al. p.233-56 of "Exponential and Critical Experiments. Vol. II." Vienna, International Atomic Energy Agency, 1964.

The zero-power reactor KRITO is intended for critical experiments on light-water-moderated power reactors using fuel with low enrichment. The first experimental program is part of a joint undertaking of RCN and Euratom for the development of a nuclear reactor for ship propulsion, known as the NERO-project. Thus the primary objective is the measurement of reactor physics parameters of the designed NERO-core. This design foresees a two-zone core of UO_2 fuel canned in Zircaloy and 12 uniformly distributed control rods of a cadmium–silver–indium alloy, with enrichments of 2, 1, and 3.8%. However, for reasons of economy, in KRITO use is made of aluminum as canning material and B_4C as poison material and the experiments will be done with a constant moderator-to-fuel ratio. A short description of the facility and the experimental program is given. First criticality was attained on 29 March 1963. The results obtained until September 1963 are summarized. (auth)

26884 MEASUREMENTS OF VOID EFFECTS IN THE ZERO-POWER CRITICAL FACILITY NORA. K. Bryhn-Ingebrigtsen, V. O. Eriksen, J. Schatvet, A. Ukkestad, J. I. Wood, and K. Oefjord (Institutt for Atomenergi, Kjeller, Norway). p.291-311 of "Exponential and Critical Experiments. Vol. II." Vienna, International Atomic Energy Agency, 1964.

Reactivity effects of voids in a reactor core is of particular importance in boiling-water reactors. Nonuniform distributions of voids make it desirable to know and understand the spatial dependence of the void reactivity effect. An experimental study of void effects under physically clean conditions was undertaken in NORA. Shrouds surrounding each individual fuel stringer define annular regions, which are voided by introduction of air under pressure. For single-rod experiments, reactivity effects are so small that it is preferable to oscillate the void volume periodically and analyze the corresponding modulation of power to obtain reactivity equivalents. Multiple-rod experiments are done statically. The experimental technique is described together with examples of its use to measure single-rod void effects, voided rod interactions, and full-voided core effects. (auth)

26885 SPECTRAL INDEX MEASUREMENTS IN WATER-MODERATED BARE HOMOGENEOUS ASSEMBLIES. C. Clouet d'Orval, J. G. Bruna, M. Cadilhac, and J. Moret-Bailly (Centre d'Etudes Nucleaires, Saclay, France). p.313-38 of "Exponential and Critical Experiments. Vol. II." Vienna, International Atomic Energy Agency, 1964. (In French)

Theoretical studies on thermalizers have led to the development of various models for determining the neutron spectrum in a medium consisting of a moderator and an absorber. The chemical and crystalline structure of the medium must be taken into consideration in studying energy exchanges between the neutrons in it. Moreover, absorption is not necessarily of the 1/v type and may include resonances. Spectrum calculations are now in progress for water and it is of value to carry out similar experimental studies on simple media such as solutions of fissionable salts, which permit very direct comparisons to be made

with the calculated results. Spectral index measurements were carried out using two small fission chambers, one of which contained a plutonium deposit and the other a uranium-235 deposit. The variation in response of these chambers can be used to distinguish any changes in the neutron spectrum, since the fission cross sections of these two bodies do not follow the same law as a function of energy. The medium studied with the aid of these chambers is a solution of fissionable material (plutonium and, later, uranium-235), made critical in the ALECTO reactor, in which the concentration of fissionable salt can be varied and, hence, the neutron spectrum modified. The counting-rate ratio of the two chambers is studied for different concentrations, and it is standardized by measuring the ratio in a very "thermal" environment with no absorption other than that of the moderator. The results given refer to a plutonium–water medium, and for concentrations varying by a factor of 3 the variation in the measured ratio is more than 10%. (auth)

26886 DETERMINATION OF D_2O-2% ENRICHED URANIUM LATTICE PARAMETERS BY MEANS OF A CRITICAL SYSTEM. N. Raisic, S. Takac, H. Markovic, and T. Bosevski (Inst. of Nuclear Science "Boris Kidrich", Belgrade). p.509-26 of "Exponential and Critical Experiments. Vol. II." Vienna, International Atomic Energy Agency, 1964.

A series of experiments performed to determine the basic parameters of a D_2O-2% enriched-uranium lattice are described. The fuel elements were hollow cylinders, canned in aluminum and wetted by heavy water both on the inside and outside. The experiments were performed on the RB critical assembly of the Boris Kidrič Institute of Nuclear Sciences in Belgrade. The clean geometry of this system enables a rather simple theoretical interpretation of experimental results, and straightforward comparison with two-group diffusion-theory calculations. Measurements performed for ten different lattice configurations included determination of buckling, water-level reactivity coefficient, and disadvantage factors for thermal- and epithermal-neutron flux inside a reactor cell. Techniques for these measurements are described. The experimental data are then used to derive the lattice parameters defined by the four-factor formula and two-group diffusion-theory treatment of the reactor core. The results are compared with the standard calculations of the same parameters for measured lattice configurations. Deviations are found in the value of n and resonance integral for ^{235}U. An analysis is made of the usefulness and accuracy of information obtained from critical experiments for design and exploitation of a research reactor, composed of D_2O and enriched uranium. (auth)

Design and Feasibility

26887 IMPROVEMENTS IN OR RELATING TO HETEROGENEOUS NUCLEAR REACTORS. (to Siemens-Schuckertwerke AG). British Patent 957,789. May 13, 1964. Priority date July 23, 1959, Germany.

A heterogeneous reactor is designed for increased self-stabilization. The reactor has fuel element passages through which a coolant having moderating properties is passed. A part of the moderator space is separated from the rest of the space by partitions and is connected to the passages in such a manner that hot coolant passes therethrough during reactor operation. Several embodiments of the reactor are described. (D.L.C.)

26888 A PROCESS FOR PRODUCING ENERGY FROM FISSILE MATERIAL. (to Siemens Schuckertwerke AG). British Patent 957,955. May 13, 1964. Priority date Aug. 3, 1960, Germany.

A homogeneous reactor is designed in which the fuel in the form of grains, dust, or powder is suspended in coolant by means of obliquely tangential injection of the coolant into the vessel and/or stirring means. The fuel suspension zone is an annular zone spaced from the vessel wall, and the heat produced in the nuclear reaction is removed at one end of the vessel by the rotary flow of coolant. The fabrication costs of such a reactor are very small compared with heterogeneous reactors, and the coolant can be a liquid (D_2O or liquid metal) or a gas (CO_2). Two embodiments of the reactor are described. (D.L.C.)

26889 IMPROVEMENTS IN OR RELATING TO FAST NUCLEAR REACTORS. Ronald Tunstall Ackroyd and Maurice Arthur Perks (to United Kingdom Atomic Energy Authority). British Patent 958,088. May 13, 1964. Filed Apr. 13, 1962.

A fast reactor is designed for reduced reactivity in event of melting of the fuel. In the reactor, a bed of moderator is located below the core and has passages for receiving molten fuel. The bed may be made of graphite blocks containing a neutron absorber such as boron. Two embodiments of the core-bed arrangement are described. (D.L.C.)

26890 IMPROVEMENTS RELATING TO NUCLEAR REACTORS. Stanley Hackney and Ronald Peter Williams (to United Kingdom Atomic Energy Authority). British Patent 958,629. May 21, 1964. Filed July 5, 1962.

A boiling water reactor is designed to be fail-safe, i.e., the fuel tubes are kept immersed in liquid water. The reactor comprises a reactor core in a vessel, a coolant flow path through the core, a fluid-tight coolant reservoir surrounding the core within the vessel, an outlet from the reservoir, and inlets to the reservoir which are fitted with non-return valves. In the event of rupture of the inlets, the non-return valves prevent the coolant from being lost. (D.L.C.)

26891 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. James Douglas Thorn and Ronald Scott Challender (to United Kingdom Atomic Energy Authority). British Patent 959,537. June 3, 1964. Filed June 4, 1962.

A reactor with a core structure of the kind described in British Patent 850,014, in which the columns are held together in operation by pressure differentials in the coolant, is designed with means for preventing disruption of the core in event of a rapid loss of inlet coolant pressure. The means comprises a retaining wall around the core structure; it may be a cylinder of graphite blocks sprung by elastic garters. (D.L.C.)

26892 NEUTRONIC REACTOR SYSTEM. Walter H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent 3,136,699. June 9, 1964.

A neutronic reactor system is designed with moving chains of fuel elements. The reactor comprises a vault containing a mass of graphite having longitudinal passages therein in the upper portion of the vault and a tank containing water in the lower portion of the vault, a plurality of endless chains of fluid-tight cartridges of aluminum each containing a body of uranium, and means for driving the endless chains whereby the uranium bodies traverse the graphite mass and cause a chain reaction therein and then traverse the tank of water and are cooled therein. (AEC)

Fuels

26893 (ANL-6868(p.11-108)) FAST REACTOR FUEL ELEMENT DEVELOPMENT AND FABRICATION. (Argonne National Lab., Ill.).

The development, fabrication, performance, properties, and irradiation testing of fuel reactor fuel elements and fuels, in particular those of EBR-I, EBR-II, and FARET, are evaluated. (N.W.R.)

26894 (ANL-6868(p.109-16)) DEVELOPMENT AND FABRICATION OF BORAX-V SUPERHEAT FUEL ELEMENTS. (Argonne National Lab., Ill.).

The development, fabrication, and testing of superheat fuel elements for Borax-V are evaluated. The properties of types 405 and 406 stainless steels as fuel claddings are characterized. (N.W.R.)

26895 (ANL-6868(p.117-19)) PLUTONIUM RECYCLE FUEL ELEMENTS AND CONTROL RODS. (Argonne National Lab., Ill.).

The properties of plutonium and its compounds as fuel materials for light water reactors are investigated. The development and fabrication of EBWR fuel elements and control rods are discussed. (N.W.R.)

26896 (ANL-6868(p.133-74)) DEVELOPMENT OF CERAMIC FUELS AND HIGH ABSORBING MATERIALS. (Argonne National Lab., Ill.).

The development of ceramic fuels and high absorbing materials is evaluated with respect to preparation, phase studies, structure, thermal properties, oxidation, reduction and reaction. (N.W.R.)

26897 ANL-6868(p.175-87)) EXPERIMENTAL IRRADIATION OF FUEL AND CONTROL MATERIALS. (Argonne National Lab., Ill.).

Examination and evaluation of reactor fuel elements that were irradiated under simulated conditions are made. Evaluation of silver–indium–cadmium alloys as control rod materials is given. Radiation effects on compressive strength and cobalt-60 production of cobalt–dysprosium oxide systems are investigated. (N.W.R.)

26898 (ANL-6868(p.188-9)) EXAMINATION OF FULL-SCALE REACTOR FUEL ELEMENTS. (Argonne National Lab., Ill.).

An evaluation is made of EBWR fuel elements after 100-Mw run and damaged Borax-V superheater fuel elements. (N.W.R.)

26899 (HW-50086) CALCULATIONS OF AVERAGE THERMAL FLUX IN THE FUEL ELEMENT OF A REACTOR. E. R. Astley (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 6, 1957. Contract AT(45-1)-1350. 8p.

Equations are introduced and examples are solved. (R.E.U.)

26900 (HW-80523(Rev.1)) BOILING BURNOUT EXPERIMENTS WITH FOG-COOLED NINETEEN-ROD BUNDLE TEST SECTIONS. G. M. Hesson, D. E. Fitzsimmons, and J. M. Batch (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 1964. Contract AT(45-1)-1350. 50p.

Heat transfer experiments were made with electrically heated models of a rod-19 fuel element under boiling burnout conditions. The experiments were performed at coolant flow rates of 5×10^5 to 2×10^6 lb/hr-ft^2 and inlet steam qualities of 0 to 30%. An inverse mass flow effect was observed, and a possible cross-over to direct mass flow was found at outlet qualities of about 10%. An upstream flow diverter was used for half of the experiments. See also HW-80523 (NSA 18: 10228). (R.E.U.)

26901 (NUMEC-2389-2) DEVELOPMENT OF PLUTONIUM-BEARING FUEL MATERIALS. Monthly Progress Letter, January 1964. Karl H. Puechl (Nuclear Materials and Equipment Corp., Apollo, Penna.). Feb. 10, 1964. Contract AT(30-1)-2389. 6p.

Results of a continuous Pu(IV)-oxalate-precipitation process for production of PuO_2 powders are tabulated. The properties of the powders formed are evaluated. (T.F.H.)

26902 KEY TO EXPANSION OF THE CIVILIAN ATOM: FUEL ELEMENTS. Camille Laurent. Atomes (Paris), No. 210, 139-44(May 1964). (In French)

Five types of fuel element rods, developed for French reactors, are described. The beginnings of fuel element fabrication in the six countries in Euratom and the five power reactors using Euratom technical aid are surveyed. Out-of-pile and in-pile fuel element studies for five French reactors are reviewed. Problems in the retreatment of irradiated fuel elements and in the design of steel and lead containers for fuel element transportation are discussed. (M.J.T.)

26903 ANALYSIS OF NUCLEAR FUEL ELEMENTS. I. DISSOLUTION OF IRRADIATED URANIUM SAMPLES. H. Sorantin, H. Bildstein, N. Getoff, V. Pfeifer, and H. Titze (Reaktorzentrum, Seibersdorf, Austria). Atompraxis, 10: 167-71(Apr. 1964). (In German)

A simple apparatus for the dissolution of uranium fuel samples is described. Activity curves for an irradiation time of eight days are shown for the different bromine-, krypton-, xenon-, and iodine isotopes. Dissolving media for uranium metal, uranium oxides, and U–Mo alloys are cited as well as for canning materials as Al, Mg, and stainless steel. Absorption of fission gases and decontamination procedures are discussed. (auth)

26904 SOME ASPECTS OF THE ECONOMY OF NUCLEAR FUELS. J. Gaussens and L. Thiriet. Chim. Ind. (Paris), 89: 623-35(June 1963).

The authors highlight the fuel expenditure item in general economic management of atomic power plants, and then go on to deal with outputs, investment and costs of plant involved in the fuel cycle. In this way they arrive at an examination from the point of view of economics, of the extraction, concentration and processing of natural metallic uranium, UO_2, UF_6, enriched uranium, and plutonium, together with manufacture of fuels. Finally, they discuss the stages in chemical processing of irradiated fuels and radioactive effluents. In their conclusion, they stress the complex nature of cost and price estimates in the nuclear field. (Sum. Articles French Tech. Press, No. 6, 1963)

26905 HEAT TRANSFER ASPECTS OF FUEL ELEMENT DEVELOPMENT FOR GAS-COOLED NUCLEAR REACTORS. K. R. Lawther and A. Draycott. Inst. Engrs., Australia. Elec. Mech. Eng. Trans., EM5, No. 1, 1-6(May 1963).

The importance of heat transfer considerations in fuel element design for large gas-cooled nuclear reactors is discussed, and the influence of heat transfer aspects on the development of such fuel elements is reviewed. Methods of improving fuel element heat transfer by increasing the heat transfer surface and by increasing the forced convective heat transfer coefficient are considered. It is usually desirable to have the coolant outlet temperature

approach the maximum fuel element surface temperature as closely as possible, and this may be achieved most effectively by employing roughened surfaces, possibly combined with suitable variation in channel size. (auth)

26906 INSTABILITY OF CYLINDRICAL REACTOR FUEL ELEMENTS. Benjamin Mingli Ma. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 133p.

The origin of the physical and mechanical instability developed in fuel elements is mainly the thermal and radiation effects, viz. thermal-cycling growth, irradiation growth, and swelling of the fissile materials. Thermal-cycling growth is manifest in the form of substantial dimensional and structural changes in the uranium fuel. The extent of the growth is a function of the number of cycles to which the fuel is subjected. The mechanisms of irradiation growth and swelling of uranium fuel are different. Irradiation growth is a dimensional instability due to the basic anisotropy of the fuel, while irradiation swelling is a volumetric instability due to agglomeration of the inert gases, ^{85}Kr and ^{133}Xe, of fission products in the fuel. The extent of irradiation growth and swelling, however, increases in the same manner with the rate and percentage of burn-up of the fuel. Apart from the instability induced by the thermal-cycling growth, irradiation growth and swelling of the fuel, both metallic and ceramic fissile materials also exhibit high plasticity and accelerated creep through irradiation and burnup when the fuel elements are in operation. In fact, the physical and mechanical instability produced by the radiation damage generally becomes more pronounced in ^{235}U enriched fuel elements. An internally and externally cooled cylindrical fuel element in the central lattice cell of a heterogeneous power reactor is considered. From the diffusion equations the thermal neutron flux distribution in the fuel element is obtained in terms of the modified Bessel functions or the simplified parabolic function. The known relation between neutron flux distribution and rate of volumetric heat generation produced by fission is utilized and through the heat conduction analysis, the temperature distribution in the fuel zone is determined. From the temperature distribution obtained and the basic assumptions given, a realistic mechanical analysis, on the basis of thermal and irradiation creep, for the strain and stress distribution in the fuel element is carried out. Based on the calculated results of the mechanical analysis, some important conclusions are drawn below: (1) The order of magnitude of the neutron flux as well as the total integrated flux distributed in the fuel zone has great effect on the components of creep strain and stress developed in the fuel element. (2) The strain parameters ϵ_{i_θ} and ϵ_{i_z} play important roles in the physical and mechanical stability of the fuel element. (3) Strength and behavior of cladding material may control the modes of strain and stress of the mechanical response as well as mechanical stability of the fuel element. (4) In view of the thermal and irradiation creep analysis considered, a thermoelastic, elasto-plastic or non-irradiated inelastic analysis for strain and stress distribution in the fuel elements used for nuclear power reactors is inadequate. (Dissertation Abstr.)

26907 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. (to Babcock and Wilcox Co.). British Patent 958,446. Priority date Oct. 3, 1961, United States.

A method for closing the end of fuel pin tubes is given which is particularly suited for the case where the tubing is stainless steel with 0.03 to 0.05% boron and hence is susceptible to cracking during welding. In the method, the end closure member is a circular cup-shaped member closed at its inner end and having its outer end (cup lip) united with the tube by a seal weld in a groove between the member and the tube. The gradual tapering of the side wall of the closure member results in a uniform yielding of the tube wall, and a reliable weld can be made by an automatic welding machine. (D.L.C.)

26908 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Colin David Reid (to United Kingdom Atomic Energy Authority). British Patent 958,684. May 21, 1964. Filed Oct. 10, 1960.

A reactor fuel element of the type having helical heat transfer fins and longitudinal splitter fins, is designed for stabilization against coolant flow. The splitter fins are formed with L-sections or other shapes arranged along the outside regions of the fins so that the fins have axial and radial asymmetry and a transverse force at one end of the fuel element is developed which urges the fuel element against the channel wall. (D.L.C.)

26909 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUEL ELEMENTS. Peter Waine (to United Kingdom Atomic Energy Authority). British Patent 958,697. May 21, 1964. Filed Aug. 1, 1961.

A reactor fuel element comprising a stack of pellets of ceramic fuel enclosed in a metal sheath, is designed so that the stack of pellets can be of greater length without encountering instability problems. The stack is divided by at least one pellet of a nonfissionable material which retains its strength under irradiation. The pellet has a circumferential groove into which the sheath is indented, and it may be made out of alumina, beryllia, or magnesia. Several embodiments of the fuel element are described. (D.L.C.)

26910 IMPROVEMENTS IN AND RELATING TO STABILISING DEVICES FOR BODIES LOCATED IN A CHANNEL OR BORE. Terence Graham Bryant (to Nuclear Power Co. Ltd. and AEI-John Thompson Nuclear Energy Co. Ltd. British Patent 958,903. May 27, 1964. Filed Nov. 24, 1961.

A stabilizing device is designed for a fuel element which is located vertically in a channel in a reactor moderator. The device comprises radial arms extending between the element and the channel, the arms having an aerofoil cross section and being arranged to produce on the element resultant force which is sufficient to overcome any disturbing forces produced by the coolant flow over the element. (D.L.C.)

26911 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Clifford Charles Horton (to Rolls-Royce Ltd.). British Patent 959,386. June 3, 1964. Filed Oct. 5, 1960.

A cluster fuel element is designed to reduce the flux depression at the center of the cluster and to improve the power rating. The fuel element comprises a ring of 6 or 12 parallel canned fuel rods encased in a steel casing and surrounding a central nonfissile mass of e.g. magnesia. The improved thermal neutron flux distribution obtained with the fuel element is described. (D.L.C.)

26912 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Peter Waine and James Duncan Waters (United Kingdom Atomic Energy Authority). British Patent 959,470. June 3, 1964. Filed May 24, 1961.

A cluster-type fuel element is designed for reduced risk of collapse of the grid support structures. In the element, the located ends of the fuel rods are joined to the grid sup-

port structures by circumferential seam welds or brazing so that relative movement between the rods and structures is prevented. (D.L.C.)

26913 TUBULAR HEAT EXCHANGER ELEMENT WITH FINS. Ennemond Maillet (to Commissariat á l'Energie Atomique). British Patent 960,349. June 30, 1964. Priority date Jan. 26, 1962, France.

A fuel slug can is designed with fins arranged in a herringbone pattern to increase heat transfer. The fins are spaced apart at relatively small distances, are oriented at an oblique angle, and are arranged in an even number of sectors around the can, the fins in two adjacent sectors being inclined in opposite directions. The fins in each sector are parallel to each other and of constant height over their whole length. Two embodiments of the can are described. (D.L.C.)

Power and Power-Breeder Reactors

Refer also to abstract 26259.

26914 (ACNP-63031) PATHFINDER ATOMIC POWER PLANT. FABRICATION DEVELOPMENT OF COLLAPSE CLAD. E. A. Wick, E. S. Boyko, and R. A. Boschke (Allis-Chalmers Mfg. Co. Atomic Energy Div., Bethesda, Md.). May 15, 1964. For Northern States Power Co., Minneapolis and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. 30p.

The development of draw bonding and stretch bonding processes for the fabrication of fuel pins for the Sioux Falls Power Reactor is discussed. The methods provide for collapsing the cladding of tubular fuel elements onto low-enrichment UO_2 pellets. Test results are presented. (R.E.U.)

26915 (DLCS-5000364) MONTHLY OPERATING REPORT [ON SHIPPINGPORT ATOMIC POWER STATION], MARCH 1964. (Duquesne Light Co., Shippingport, Penna.). Contract AT(11-1)-292. 48p.

The station remained shut down, and the PWR modification work encompassing the replacement of Core 1 with Core 2 was in progress. The decontamination operation, overall refueling, and reactor plant modifications were performed. An incident occurred during the disassembly of Core 1 mechanisms on the reactor vessel head. An excessive reactor coolant temperature was experienced which resulted in the emission of steam vapor from a fuel port temporarily suspending the refueling operation. Decontamination of the RCS was completed. The alkaline permanganate and the diammonium acid citrate solution phases of the decontamination process are described. The process did remove deposited contamination from the reactor coolant piping, however, redeposition occurred in low flow areas. There were no personnel overexposures and special control measures employed effectively reduced the high radiation levels to acceptable limits. Core 1–Core 2 procedure preparation, material procurement and packaging, pre-assembly operations, and inspection of components were also in progress throughout the month. Work was started to disconnect the decontamination system from the RCS following completion of the decontamination operation. (auth)

26916 (DLCS-5000464) MONTHLY OPERATING REPORT [ON SHIPPINGPORT ATOMIC POWER STATION], APRIL 1964. (Duquesne Light Co., Shippingport, Penna.). Contract AT(11-1)-292. 39p.

The modification of the reactor plant for Core 2 operations and the replacement of Core 1 with Core 2 continued. Special water sampling was required in conjunction with the refueling operations due to the turbidity of the reactor vessel water. The water condition was corrected by flushing the vessel with 35,000 gallons of water to the RWDS. Two separate ion exchange systems were utilized for the processing of the water accumulated in the RWDS. There were no overexposures of personnel. Portions of the decontamination system were modified for processing liquid waste from the laydown building. (auth)

26917 (DM-72) HOW MUCH OF THE ROCKS AND THE OCEANS FOR POWER? EXPLOITING THE URANIUM–THORIUM FISSION CYCLE. W. B. Lewis (Atomic Energy of Canada Ltd., Chalk River, Ont.). Apr. 1964. 33p. (AECL-1916)

When rich uranium ores become scarce, the price will rise from $13/kg U, but with improved techniques of extraction and the choice of an economical fuel cycle, abundant uranium for many centuries appears to be available in the rocks and the oceans. Even from reactors already developed to the stage of engineering design it is possible to choose a fuel cycle to which uranium at $250/kg U would contribute no more than 2 mill/kwh. Without suggesting when such a high cost might be reached, its implications are examined. The optimum fuel cycle would balance the financing charges on the fuel inventory and the costs of fuel make-up supply and reprocessing. By using uranium and thorium in combination it was calculated that at least 50,000 Mwd can be derived per ton of uranium. At a net conversion efficiency of 30% and an overall rating of 6 thermal kw/kg, the natural uranium inventory would cost at the suggested high price $250/(6 × 0.3) = $139/ekw and for 7000 hr/yr at 7% annual charges would contribute 1.4 mill/ekwh. At 50 Mwd/kg U the make-up supply contributes 250/(50 × 24 × 0.3) = 0.7 mill/ekwh. Probably higher efficiency and possibly higher specific power ratings would be used to lower such costs. The value of uranium is related to its content of the fissile ^{235}U, and even though most power may be derived from thorium, it was concluded that its value will not rise comparably with that of uranium. The total cost of nuclear power also includes contributions from the cost of equipment and plant operation as well as from costs of fabricating and processing materials. Any other technique or fuel cycle is considered unable to supplant the thermal fission reactors merely by showing a lower demand for fissile material, but if plant and operating costs are not excessive, may enter the competition or become a valuable supplement. Three such techniques recognized are: fast neutron breeders, neutron production by the excitation of heavy nuclei to high energies, and controlled thermonuclear fusion. (auth)

26918 (EUR-1802.d) KERNZENTRUM GUNDREMMINGEN (KRB). Jahresbericht 1963. (Gundremmingen (KRB) Nuclear Power Plant. Annual Report 1963. (Kernkraftwerk RWE-Bayerwerk G.m.b.H., Gundremmingen, Germany). 1964. 52p.

The design, development, construction, economics, characteristics, and testing of the KRB Power Reactor and its components are summarized. (N.W.R.)

26919 (EUR-1803.i) CENTRALE ELETTRONUCLEARE DEL GARIGLIANO. Relazione Annuale 1963. (Garigliano Nuclear Power Plant. Annual Report 1963). (Società Elettronucleare Nazionale, Rome). 1964. 118p.

The development, construction, modifications, and test-

ing of the Garigliano Nuclear Power Plant are described. (N.W.R.)

26920 (EUR-1804.f) CENTRALE ELECTRONUCLEAIRE DE CHOOZ. Rapport Annuel 1963. (Chooz Nuclear Power Plant. Annual Report 1963). Société d'Energie Nucléaire Franco-Belge des Ardennes, Chooz-lez-Givet, France). 1964. 69p.

The development, design, construction, economics, operation, and testing of the SENA Power Reactor are summarized. (N.W.R.)

26921 (EUR-1810.i) CENTRALE ELETTRONUCLEARE DI LATINA RELAZIONE ANNUALE, 1963. (Latina Nuclear Power Plant—Annual Report, 1963). (Societa Italiana Meridionale Energia Atomica, Latina). 1964. 59p.

The development, construction, testing, and performance of the SIMEA Reactor and its components are summarized. Two papers: Description of the First Fast Burst Occurring in Latina Reactor and Description of the Failure and Successive Recovery of Reactor Control Rods, are abstracted separately. (N.W.R.)

For abstracts of individual papers see: 26922 and 26923.

26922 (EUR-1810.i(Paper 5)) DESCRIZIONE DEL PRIMO "BURST VELOCE" VERIFICATOSI NEL REATTORE DI LATINA. (Description of the First "Fast Burst" Occurring in Latina Reactor). R. Giannini and G. Lesnoni (Societa Italiana Meridionale Energia Atomica, Latina). 9p.

The first fast burst occurring in SIMEA Reactor is described. (N.W.R.)

26923 (EUR-1810.i(Paper 6)) DESCRIZIONE DELLA CADUTA E SUCCESSIVO RECUPERO DI UNA BARRA DI CONTROLLO NEL REATTORE. (Description of the Failure and Successive Recovery of Reactor Control Rods). G. Lesnoni and P. Landini (Societa Italiana Meridionale Energia Atomica, Latina). 14p.

The operation of the control rods in the SIMEA Reactor is described. A description of the failures and successive recoveries are analyzed. (N.W.R.)

26924 (EURAEC-1065) IMPROVEMENT OF BOILING WATER REACTOR STABILITY THROUGH MINIMIZATION OF BOILING NOISE. Third Quarterly Progress Report, January 1, 1964–April 30, 1964. Lynn E. Weaver and Loren R. Peterson (Arizona. Univ., Tucson. Engineering Research Lab.). Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(11-1)-1311. 89p.

The performance index used is the Minimization of the Mean Square Value of the Reactor Noise. In the work previously reported, the approach to the solution of the problem of minimizing boiling reactor noise and increasing system stability was based on the work of Dr. Norbert Wiener. Two different design criteria were formulated and applied to a simplified model of EBWR. The first criterion entitled Mean Square Error Minimization of Reactor Noise was used to develop optimum mathematical models of reactor control systems that minimized the mean square value of the random flux variations, with a saturation constraint applied to the control system. Results of this investigation indicated that considerable reduction in reactor noise could be accomplished, however, there was no assurance that the system designed would yield well-behaved transient response characteristics. To assure good transient response characteristics while minimizing the mean squared value of the reactor noise, a second criterion, based on the work of G. C. Newton, was investigated. This technique called, "Minimization of Reactor Noise through Minimum Bandwidth Control" was applied to the simplified model of EBWR. The results of this investigation indicate that a sizeable reduction in the mean square value of the random flux variations can be accomplished and the corresponding system will exhibit very well-behaved transient response characteristics. These two methods have shown the merits of using Wiener theory in the design of an optimum system to minimize boiling noise. There are however several drawbacks in using Wiener theory. The mathematical sophistication and algebraic complexity greatly increases as more realistic and complex models for the reactor are assumed. Physical intuition is lost among the numerous digital calculations required for complex systems. Recent techniques developed by Dr. R. B. Streets, Jr., which practically eliminate these serious drawbacks, are presented and applied to a complex model of a boiling water reactor. Using Streets' method, a considerable physical insight is obtained as to the basic structural properties of optimum systems to minimize reactor noise. It was found that a reactor control system independent of reactor power level, except for possibly a gain constant, could be designed that would minimize boiling noise at all power levels. This is a significant finding in that it eliminates the need for a complex adaptive control system to account for the dependency of the reactor control system on reactor power level. Simulation studies have verified these findings. (auth)

26925 (GEAP-4423) REACTOR PRESSURE VESSEL MATERIAL SURVEILLANCE PROGRAM AT THE GARIGLIANO NUCLEAR POWER PLANT. F. A. Brandt and I. R. Kobsa (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Mar. 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(04-3)-189. 97p. (EURAEC-1055)

A program was established to monitor the effect of neutrons and time at temperature on the mechanical properties of the reactor pressure vessel steel of the SENN Garigliano Nuclear Power Plant. Tensile and Charpy V impact specimens were made of steel (SA336 Code Case 1236) taken from the pressure vessel forgings, and of weld metal and weld-heat-affected zone metal taken from a weldment simulating a vessel circumferential weld. The specimen materials were given a heat treatment simulating the post-weld heat treatment given the material in the vessel near the core. The specimens were sealed in helium-filled capsules. Groups of these were mounted on racks and placed in positions near the reactor core, near the pressure vessel interior wall and in the reactor steam drum. Selected groups of capsules will be removed at intervals of ½, 1, 2, 4, 8, 16, and 32 years. The specimens will be tested in a radiomaterials laboratory to determine tensile properties and impact transition temperature changes. The relationship between laboratory tests and pressure vessel behavior is discussed as a means for interpretation of the surveillance test data. Detailed accounts of material characteristics and specimen fabrication are given. Instructions are included for handling the program equipment at the reactor and at the hot laboratory. A complete set of drawings showing each item of equipment placed in the reactor is provided. There are several tables outlining the specimen types and their exposure periods. The coding systems used to identify specimens, materials, and specimen holders are described. Periodic reports will be required as the

specimens are removed and tested. These reports will serve as a guide to the reactor operators, and will provide general information on materials behavior in reactor environments. (auth)

26926 (TID-20605) CONSIDERATION OF TECHNICAL FEASIBILITY AND ENERGY COSTS. (American Electric Power Service Corp., New York). Mar. 1, 1960. Contract AT(38-1)-200. 88p.

The status of research and development of a gas-cooled, heavy-water-moderated, pressure-tube reactor (GCPTR) for East Central Nuclear Group and Florida West Coast Nuclear Group is discussed. Prototype relations to full-scale operation and to conventional power plants are discussed. The conceptual design is for a 300,000 kw(e) natural uranium power plant. (R.E.U.)

26927 (TID-20647) STUDY OF HIGHER ISOTOPE PRODUCTION AS A USEFUL BY-PRODUCT IN FAST POWER REACTORS. John T. Madell (Argonne National Lab., Ill.). May 3, 1962. Contract W-31-109-eng-38. 23p.

A study of the possible economic value of the higher isotopes that are formed as by-products in a fast power reactor was made. A literature search revealed that it is technically feasible to produce and separate higher isotopes. The production rates of two important higher isotopes, ^{237}Np and ^{241}Am, were calculated as a function of the power output of the reactor. The calculations showed that a credit (sale price minus separation cost) of $500/gm of ^{237}Np and a credit or $1000/gm of ^{241}Am will each reduce the power costs by one mil/kw hr. The present sale price of ^{237}Np and ^{241}Am produced in thermal reactors is $500/gm and $1500/gm, respectively. Since the production rates are lower and the separation costs are higher for the isotopes in a fast reactor than in a thermal reactor, little or no reduction in the power costs of a fast reactor is presently expected from the sale of ^{237}Np and ^{241}Am. However, if the demand for ^{237}Np and ^{241}Am should exceed the production from thermal reactors, fast power reactors would be an attractive source of the isotopes. (auth)

26928 (WCAP-2294) 1000-MWE SUPERCRITICAL PRESSURE NUCLEAR POWER PLANT DETAILED COST ANALYSIS. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). [1962]. Contract AT(30-1)-2948. 57p.

Detailed cost studies for a 1000-Mw(e) Supercritical Once-Through Tube Reactor (SCOTT-R) are presented. The AEC Guide to Nuclear Power Cost Evaluation was used where practical. Capital, fuel, operation and maintenance, and insurance costs are computed. The estimated, as designed, total power cost is 4.18 mill/kwh with potential reduction to 3.80 mill/kwh. Estimated plant costs resulting from the use of 400 pressure tubes instead of 540 are given. The estimated total power cost given is 4.02 mill/kwh with potential reduction to 3.70 mill/kwh. (auth)

26929 VICTORIA AND NUCLEAR POWER. F. R. Hooper (State Electricity Commission, Victoria, Australia). At. Energy Australia, 7: No. 2, 17-22(Apr. 1964).

The development of power generation in Victoria, Australia is reviewed, and the future need for nuclear power is evaluated. (C.E.S.)

26930 POWER REACTORS AND THEIR ECONOMICS. A. Setzwein (Brown-Boveri Krupp, GmbH, Mannheim, Ger.). Atompraxis, 10: 174-5(Apr. 1964). (In German)

A survey was made of the power reactors that are in development, under construction, or in operation. A critical examination about the use of calculation of the economic feasibilities at the present time is given, along with an analysis about the cost for the electricity and a comparison of different power stations. (auth)

26931 PRODUCTION OF NUCLEAR ENERGY. Kurt Jaroschek (Technische Hochschule, Darmstadt, Ger.). Brennstaff-Waerme-Kraft, 16: 153-6(Apr. 1964). (In German)

Reactor development is reviewed. Programs for the development of light-water reactors, gas-cooled reactors, D_2O-natural uranium reactors, and sodium-cooled reactors are described. Increased uranium utilization, potentialities of fast breeders, and coming decisions that must be made are discussed. (66 references). (M.C.G.)

26932 THE NUCLEAR POWER STATION GUNDREMMINGEN OF THE "KERNKRAFTWERK RWE-BAYERN WERK GmbH." K. Peuster (Rheinisch-Westfällisches Elektrizitatswerk AG, Essen). Brennstoff-Waerme-Kraft, 16: 227-30(May 1964). (In German)

The development of the project from the first investigations concerning the capacity, economics, location, operating conditions, and safety up to the placing of the contract is summarized. A boiling water reactor offered by a German-American concern was selected for the installation, the most important details of which are given. (D.C.W.)

26933 THERMIONIC POWER GENERATION. Volney C. Wilson (General Electric Research Lab., Schenectady, N. Y.). IEEE (Inst. Elec. Electron. Engrs.), Spectrum, 1: 75-83(May 1964).

A method is outlined for the combination of thermionic converters and steam turbines to obtain more electricity from future nuclear central station power plants. Various types of converters are described and evaluated. (auth)

26934 THE ECONOMICAL SIZE OF NUCLEAR POWER STATIONS. [PART] I. D. Ufer. Kernenergie, 7: 204-17 (Apr. 1964). (In German)

It was previously shown that a nuclear power plant has an optimal economic size when the cost of producing and transporting each megawatt hour of electric energy is minimal. Based on this thesis all of the influential factors on electric energy costs in a nuclear power plant (with water-water reactor) were investigated, especially their dependence on power plant production. Chief influences were the investment costs of the power plant, which were a function of both the reactor output and the number of reactors in the power plant. The factors influencing transport costs for electric energy were also considered. For their quantitative comprehension a model was developed, which made it possible to calculate the dependence of the number and length of the cables going out from the nuclear power plant on the so-called partial load density. After ascertaining the cost for production and transport of 1 Mwh of electric energy, the minimum power was determined. It was found that the region of economical power is relatively broad and for 1970 may lie at 600 to 800 Mw and for 1990 at 1500 to 2500 Mw. (tr-auth)

26935 SAFETY SYSTEMS FOR POWER REACTORS. Dietrich v[on] Haebler (Siemens-Schuckertwerke AG, Erlangen, Ger.). Kerntechnik, 6: 163-4(Apr. 1964). (In German)

Designs and equipment for reactor safety systems for various types of power reactors are discussed. The types of signals given off by the safety system are described. (M.C.G.)

26936 SAFETY SYSTEM FOR POWER REACTORS. L. Seyfferth (Maschinenfabrik Augsburg-Nuremburg AG, Nuremburg). Kerntechnik, 6: 164-5(Apr. 1964). (In German)

Monitoring, shutdown, and alarm systems for power re-

actors are discussed. The role of each of these systems in the reactor safety system is described. (M.C.G.)

26937 MOLTEN SALTS AS REACTOR MATERIALS. W. R. Grimes (Oak Ridge National Lab., Tenn.). Nucl. News, 7: 3-8(May 1964).

The Molten Salt Reactor Experiment is briefly described, and the merits and limitations of various fuels, coolants, moderator materials, and structural materials for such a reactor are discussed. Radiation effects, materials compatability, fuel reprocessing, and fission product behavior are considered. (D.C.W.)

26938 AN EXAMINATION OF THE TIME-DEPENDENT BOWING BEHAVIOR OF FUEL ELEMENTS OF THE EXPERIMENTAL GAS-COOLED REACTOR. J. M. Corum and W. A. Shaw (Oak Ridge National Lab., Tenn.). Nucl. Sci. Eng., 19: 143-50(June 1964).

Temperature differences that will exist across the diameters of the Experimental Gas-Cooled Reactor (EGCR) fuel elements will cause the elements to bow. Since the elements are restrained at their midpoints as well as at the ends, the bowing will be accompanied by bending stresses and, as these stresses relax at the relatively high element temperatures, the bowing deflections will increase. A theoretical analysis was developed for predicting the time-dependent bowing behavior of an element subjected to a linearly distributed temperature difference across the diameter. The element behavior was considered to be a combination of creep and elastic bending. The analysis shows that, in every case, the maximum limiting deflection that an element will approach is approximately 2.63 times the initial bowing deflection, or 78% of the maximum deflection the element would have if its midpoint behaved as a plastic hinge. Although the time-dependent bowing will lead to increased temperature gradients, the analysis indicates that the additional deflection produced by the increase will be small compared to the deflection that caused the increase, and, consequently, the elements will be thermally stable. (auth)

26939 A HEAT/MASS ANALOGY FOR FISSION-PRODUCT DEPOSITION FROM GAS STREAMS. M. N. Ozisik (Univ. of North Carolina, [Chapel Hill]). Nucl. Sci. Eng., 19: 164-71(June 1964).

Diffusion is an important mechanism in the transport and deposition of very small particles from gas streams to the surfaces of a conduit. Based on the heat/mass analogy, an analytical model was formulated for the deposition of the precursor (i.e., the fission product that first enters the gas stream) and for its first and second daughter products from laminar and turbulent gas streams under steady-state conditions. The model is strictly applicable to deposition in the isothermal regions; axial temperature gradients were found to alter the deposition pattern. Activity deposited on the surfaces of a conduit was correlated with this model both for the molecular and larger size particles (0.004 μ) assuming a perfect-sink condition at the wall surface. There is experimental evidence that wall surfaces do not always act as a perfect sink for the colliding particles; effects of an imperfect-retention scheme were included in the analysis by introducing a factor for the effectiveness of the wall surfaces in retaining the particles. No rational evaluation of this factor is known. However, activity deposited on such surfaces can be correlated with the model developed if a suitable value is chosen for this factor. (auth)

26940 THE BREEDERS OR SURREGENERATOR REACTORS WILL AVOID THE GREAT WASTE OF NATURAL URANIUM. Yves Meriel. Science Progr.-Nature, No. 3345, 1-9(Jan. 1964). (In French)

The principles, merits, design, cooling, and future of breeder reactors are discussed. The Rapsodie reactor is considered as an example. (D.C.W.)

26941 DESIGN OF BOILERS FOR POWER PLANTS WITH GAS COOLED REACTORS. O. Bellofatto and E. Torielli. Termotecnica (Milan), 17: 671-84(1963). (In Italian)

In the design of gas-cooled reactors with the boiler systems inside the pressure vessel, the study of the boiler is conditioned by the design of the reactor and the container. The parameters determining the design of boilers are the physical characteristics of the coolant gas, the temperature and pressure fields on the gas and steam side, necessity for the systemization of the boiler appurtenances and neatness, and the criteria of operational safety. Each of these parameters is discussed in some detail. The Oldbury and Latina power plants are described and compared as examples of the effects of reactor design on the design of boilers. (J.S.R.)

26942 THE GAS TURBINE AS AN AUXILIARY IN B.W.R. PLANTS. C. D'Amelio. Termotecnica (Milan), 18: 35-47(1964). (In Italian)

The use of traditional fuel in a BWR plant, not acting directly on the reactor steam but operating in combined or dual plants comprising a gas turbine and a nuclear plant, with the heat of the exhaust gas from the turbine as a heat carrier to the reactor cycle was investigated. The regeneration cycle of a gas turbine is briefly examined. The use of the heat of the exhaust gas to preheat the feed water and to produce saturated steam extracted by centrifugation along the expansion line was analyzed in detail. (J.S.R.)

26943 VOM ATOMKERN ZUM KERNKRAFTWERK. 2. NEUBEARBEITETE AUFLAGE. (From the Atomic Nucleus to the Nuclear Power Station. 2. New Revised Addition). Werner Kliefoth. Thiemig-Taschenbucher, Band 19. Munich, Verlag Karl Thiemig KG, 1963. 70p.

Measuring and counting atoms, the atomic nucleus and its shell, chemical elements and their atomic structure, transformation of chemical elements by radioactive decay and nuclear bombardment, discovery of artificial radioactivity and nuclear fission, the chain reaction for uranium fission, nuclear energy of matter and its control in a reactor, operation of a nuclear reactor, uses of atomic energy, safety precautions for reactors, and hydrogen as fuel for the future are discussed. (M.C.G.)

26944 ECONOMIC INTEGRATION OF NUCLEAR POWER INTO THE IOWA POWER SYSTEM. Alfred Franklin Rohach. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 91p.

This study presents a method for determining when nuclear power will compete with conventional power. The method is developed specifically for Iowa; however it is applicable to any other power system. The costs of power were developed analytically. The conventional power costs were separated into fixed charges, fuel, and operation and maintenance. The nuclear power costs were separated in a similar manner except foxed charges were split into nuclear fixed charges and conventional fixed charges. The conventional fixed charges pertain to the conventional portion of nuclear power plants. In the development of the nuclear costs, a detailed study was made of nuclear plant equipment. In the determination of nuclear fuel costs, equations were derived which should simplify nuclear fuel cost calculations. The power costs were derived as functions of

unit size and future time. Thus by setting the cost of conventional power equal to the cost of nuclear power, a locus of size versus time is found along which nuclear power will economically compete with conventional power. The resulting equation had load factor, fixed charge rate, and present conventional fuel cost as parameters. However, other parameters such as nuclear fuel burnup and steam cycle pressure and temperature could also be used as parameters. Solutions for the equations were obtained for 1962 conventional fuel costs of 25¢, 30¢, and 35¢ per million Btu using load factors of 70, 80, and 90%. The solutions were obtained both for first and second conventional units in the size range of 100 to 300 Mw. Results were obtained for four types of reactors: BWR, PWR, SGR, and FBR. The light water reactors, which should eventually evolve into a single type, were found to be competitive with conventional power using 30¢ per million Btu fuel in 1974 for 100 Mw units, in 1969 for 200 Mw units, and in 1967 for 300 Mw units. A fixed charge rate of 14% and a load factor of 80% were assumed. The SGR was found to be competitive with conventional power using 35¢ per million Btu fuel in 1980 for 100 Mw units, in 1971 for 200 Mw units, and in 1969 for 300 Mw units. A fixed charge rate of 14% and a load factor of 90% were assumed. The FBR does not seem to be within the competitive picture during the next two decades at least for conventional fuel costs of 35¢ per million Btu or less in the range of 100 to 300 Mw. (Dissertation Abstr.)

26945 STUDIES OF A LIGHT-WATER MODERATED FORCED-CIRCULATION REACTOR USING SUPERHEATING WITH SUBCRITICAL PRESSURE. R. Zwickler. Thesis, Berlin, Technische Hochschule. 1963, 128p. $2.00 (Gmelin, AED-DISS. 63-310). (In German)

Advantages and disadvantages of boiling water reactors with nuclear superheating are discussed. The basic design for a forced-circulation superheater reactor is given. Optimal pressure range for subcritical operation is 100 to 140 atm. Experimental results on decrease of heat exchange by evaporation are reviewed. It is concluded that decreased heat exchange does not lead to burnout in all circumstances. A critical situation can develop only after boiling at the heating surface. (Gmelin Inst.)

26946 PROGRESS IN MATERIALS, DESIGNS AND FABRICATION TECHNIQUES IN THE POWER GENERATING INDUSTRY. D. W. C. Baker (Central Electricity Generating Board, London). p.115-53 of "Advances in Materials. Inter-Disciplinary Symposium, First and Second Sessions, 6 April, 1964." London, The Institution of Chemical Engineers, 1964.

The economic and operational factors that regulate progress in the utilization of new materials, designs and fabrication techniques in the power generation industry are reviewed. The development of conventional boiler-turbine units of increasing size and level of steam conditions is outlined and the attendant improvements in materials and fabrication techniques described. Reference is made to the influence of design codes on the selection of materials for boilers and to anomalies which may arise from differences in design criteria. Attention is drawn to material requirements for components subjected to particularly arduous conditions, including: sight glasses for boiler drum water level indicators, superheater tubes exposed to flue gas corrosion, high temperature steam valves, turbine blades subjected to water droplet erosion and alternator coil binding rings. Advances in the materials and construction of ancillary plant such as condensers, feed heaters, and cooling towers are described. Brief mention is made of the introduction of new materials for the construction of station building superstructures. In the field of nuclear power the use of concrete for pressure vessels construction and the special quality requirements of stainless steel for AGR fuel element cans are topics selected for discussion. Two different combined cycle projects carbonizer/gas-turbine/steam cycle plant and (b) total gasification/gas-turbine/steam cycle plants are under study, and some of the materials problems that arise are considered. Materials and design developments are also evident in transmission and the matters considered include the use of aluminum alloys for transformer tanks, de-icing of overhead line conductors, semiconducting glazes for ceramic insulators and the prospects of utilizing superconducting materials. (auth)

26947 VOID REACTIVITY EFFECTS IN THE SECOND CHARGE OF THE HALDEN BOILING WATER REACTOR. J. E. Lunde (OECD Halden Reactor Project, Norway). p.527-59 of "Exponential and Critical Experiments. Vol. II." Vienna, International Atomic Energy Agency, 1964.

The reactivity effect of voids caused by boiling inside the coolant channels in the second fuel charge of the Halden Boiling Heavy Water Reactor was measured both in void-simulated zero-power experiments and under actual power conditions. The void-simulated experiments consisted of measuring the reactivity effect of introducing void columns inside thin-walled tubes to various depths. The tubes were placed at different positions between the stringers in a single 7-rod cluster element practically identical with the normal second-charge fuel elements. This experiment enables an investigation of the reactivity dependence upon void fraction, and also the reactivity dependence of steam-bubble position in the coolant channel. The experiment was carried out in the Norwegian zero-power facility NORA, with a core consisting of 36 second-charge elements and with a lattice geometry identical to the one in HBWR. The temperature dependence of the void effect was investigated in a zero-power experiment with the 100 fuel-element core of HBWR. In a single fuel element the water level inside the coolant channel was depressed to various depths, and the reactivity effect of this perturbation was measured at different temperatures in the temperature interval 50 to 220°C. The power void reactivity was measured in HBWR as a function of nuclear power at different moderator temperatures between 150 and 230°C at powers up to about 16 Mw at the highest temperature. The power-void reactivity coefficient is an important quantity in determining the dynamic behavior of a boiling-water reactor. The theoretical determination of this quantity is, however, complicated by the fact that knowledge about the void distribution in the core is required. The detailed power-void distribution is not easily amenable to experimental determination, and accordingly the void-simulated experiments represent a better case for testing the reactor physics calculation of void effects. Preliminary theoretical comparisons are made for these experiments. Two-group diffusion theory is applied, and the conclusion can be drawn that fair agreement is obtained between theory and experiment for the perturbations in the lattice parameters for a void fraction equal to one, both at low and high temperatures. For intermediate void fractions, however, somewhat less satisfactory agreement is found. (auth)

26948 EFFECTIVENESS OF A LARGE NUMBER OF CONTROL RODS IN THE SECOND CHARGE OF THE HALDEN BOILING WATER REACTOR. H. Smidt Olsen (OECD Halden Reactor Project, Norway). p.561-73 of "Exponential and Critical Experiments. Vol. II." Vienna, International Atomic Energy Agency, 1964.

The reactivity worth of various control-rod configurations was measured in the second fuel charge of the Halden Boiling Heavy Water Reactor (HBWR) under low power conditions. The second fuel charge of HBWR consists of 7-rod UO_2 cluster elements with 1.5% enrichment. A total of 30 control rods is placed in the open positions of the hexagonal fuel-lattice structure. In order to facilitate theoretical comparisons, measurements were made on symmetrical control-rod configurations only. The experiment consisted of measuring the critical water level for the clean core and with the different rod configurations inserted to various distances from the bottom of the reactor. The temperature dependence of the reactivity worth was investigated by performing measurements, using a ring of 6 control rods, at the three different temperatures 34, 150, and 220°C. Comparisons of the experimentally determined critical water levels and the calculated critical water levels are presented. The critical water levels are calculated both by a method in which the control rods are homogenized together with fuel and moderator to form a control-rod zone, and also by a heterogeneous method in which the fuel elements and control rods are regarded as line sinks to thermal neutrons and the fuel elements are regarded as line sources of fast neutrons. (auth)

26949 THE MERCURY-STEAM BINARY POWER CYCLE FOR NUCLEAR POWER APPLICATION. John K. Davidson, Laurence E. Phillips, and Andre H. Gage (Atomic Energy Commission, Washington, D. C.). 10p. (CONF-504-4)

From American Power Conference 26th Annual Meeting, Chicago, Apr. 1964.

The results of an evaluation on the mercury–steam binary power cycle for large liquid-metal-cooled power reactor plants are presented. Comparative studies indicated that for a sodium outlet temperature of 1200°F, the mercury–steam binary plant will have a lower heat rate than the competing sodium–water system, and that the capital cost for the entire power-removal system will also be lower. Further, the potential for improvement when higher temperatures are attainable, strongly favors the mercury–steam binary cycle. It was concluded that the mercury–steam binary, power-removal system merits development for application to large sodium-cooled power reactors. From the preliminary design studies so far performed it was further concluded that components for 500/1000 Mw(E) plants are within the present technology, and that a demonstration of the cycle on an engineering scale is the principal requirement. (P.C.H.)

26950 DESIGN OF HEAT DISSIPATION SYSTEMS FOR DUAL-PURPOSE OPERATION OF THE NEW PRODUCTION REACTOR AT HANFORD. A. J. Fiehn, F. M. DuPont, M. Zizza, and B. J. Bucalo (Burns and Roe, Inc., New York). 30p. (CONF-504-5).

From American Power Conference 26th Annual Meeting, Chicago, Apr. 1964.

Three phases of operation—plutonium production only, dual purpose, and electric-power generation only—are described. The heat-dissipation systems—the primary- and secondary-coolant systems—are surveyed. Component design and control—steam generators, primary-coolant pumps, the headering system, the secondary system, and the circulating-water system—are covered. Power generation is considered; integration of the power plant cycle, dual path to the heat sink, turbine generators, condensing equipment, and feedwater retention are discussed. (M.J.T.)

26951 IMPROVEMENTS IN OR RELATING TO STEAM TURBINE SYSTEMS. Harold John Coles (to Mitchell Engineering Ltd.) and James Dowie (to Fairfield Shipbuilding and Engineering Co. Ltd.). British Patent 950,732. Feb. 26, 1964. Filed May 20, 1959.

A steam turbine system for use with a reactor steam generator of the indirect cycle type, is designed for improved utilization efficiency of low-temperature steam. The system comprises a high-pressure turbine, a steam reheater, and a low-pressure turbine connected in flow series arrangement. The reactor is preferably of the boiling water type. (D.L.C.)

26952 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. (to Babcock and Wilcox Co.). British Patent 957,754. May 13, 1964. Priority date Dec. 1, 1960, United States.

A fuel element assembly is designed for a boiling reactor. The assembly has a first flow path for vapor generation by heat exchange at a surface of the fuel elements, means for separating the liquid from the vapor, and a second flow path for superheating the vapor by heat exchange at another surface of the fuel elements. One of the flow paths includes tubular passageways extending through the fuel elements, while the other flow path extends over the outer surfaces of the fuel elements. Several embodiments of the fuel element assembly are described. (D.L.C.)

26953 NUCLEAR POWER REACTOR WITH ROD-SHAPED FUEL ELEMENTS. Friedrich Schmiedel and Heinrich Gunter Schafstall (to Betheiligungs- und Patentverwaltungsgesellschaft Mit Beschrankter Haftung). British Patent 960,678. June 10, 1964. Filed Oct. 22, 1962.

A power reactor is designed which has no bottom grid and which includes horizontal fuel rods arranged to form a ladder-like structure. The uprights of the ladder may be hollow cylinders which communicate with the interior of the fuel rods for superheating of the coolant, and one of the uprights may be adapted for expansion of the fuel rods. The absence of a bottom grid results in a reduced pressure drop and increased heat transfer coefficient. Two embodiments of the reactor are described, one of the gas-cooled type and the other of the boiling water type. (D.L.C.)

26954 PRESSURIZER FOR PRESSURIZED WATER REACTORS. Josef Eberwein (to Siemens-Schuckertwerke AG). German Patent 1,165,172. Mar. 12, 1964. Filed Aug. 19, 1961.

The pressurizer consists of a pressure vessel equipped with submerged heater elements and a nozzle through which reactor coolant may be sprayed into the top of the vessel. The vessel is connected to the reactor coolant system by a surge line running from the bottom of the vessel to the reactor vessel. A steam phase exists in the pressurizer above the free water volume. A steam riser is vertically arranged along the axis of vessel connecting the water volume with the steam chamber. The lower portion of the riser is widened to form a funnel so that it surrounds the heater elements and shields them against the remainder of the water volume. (Gmelin Inst.)

Production Reactors

26955 (HW-81088) N REACTOR ENGINEERING DATA SYSTEM, OUTPUT REPORTING. C. F. Poor (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Feb. 28, 1964. Contract AT(45-1)-1350. 20p.

A flow sheet of the N Reactor Data System is shown; data recording, data conversion, data editing, file processing, report processing, and file applications systems are shown.

The system output will be edited data for various reactor systems. Output requirements are considered. (R.E.U.)

Propulsion and Space

26956 (MTP-ASTR-A-63-8) COMPACT LUNAR POWER STATION. Edward E. Dungan (National Aeronautics and Space Administration. George C. Marshall Space Flight Center, Huntsville, Ala.). Aug. 23, 1963. 20p. (NASA-TM-X-51372; N64-13063)

One of the initial requirements for a manned lunar scientific base will be an adequate, dependable supply of electric power. Minimum weight and long operating capabilities necessitate the use of nuclear energy. The power requirements for such a station should be in the megawatt (electrical) range. A conceptual design of a compact lunar power station includes a partially-shielded, liquid-metal cooled, fast reactor heat source; a primary heat exchanger; a redundant potassium Rankine cycle turboelectric generation system; and either a radiator or a lunar heat sink. A modular-designed compact lunar power station becomes an immediate candidate for logistic missions utilizing the Saturn V Lunar Logistic vehicle. The technology exists for designing and developing a power station of this type. (auth)

26957 (NAA-SR-8414) BOOMER—A DIGITAL PROGRAM FOR EVALUATING THE THERMAL AND KINETICS RESPONSE OF A SNAP 2/10A REACTOR. R. W. Winson (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). May 31, 1964. Contract AT (11-1)-Gen-8. 73p.

A mathematical model of the SNAP 2/10A reactor was developed describing the reactor kinetics, heat transfer, and hydrogen diffusion within the reactor core. This theoretical model was then modified, on the basis of current test data, to realistically predict the transient response of the reactor. The model was then programmed into a digital code called BOOMER. The development of this code is described in detail. The code solves the spatially discretized partial differential equations representing the heat transfer and hydrogen diffusion within an average fuel rod, the six delay-group monoenergetic kinetic equations, and all the necessary coupling equations. The output of the code presents the time solution of the SNAP 2/10A reactor transient and includes the temperature distribution axially and radially within the fuel rod, the axial temperature distribution in the coolant channel, distributed hydrogen concentration, hydrogen pressure within cladding gap, reactor power, neutron flux, and the concentrations of the delayed neutron precursors. The primary function of BOOMER is to represent the response of the reactor to large reactivity ramp and step insertions. (auth)

26958 (NP-12562) DYNAMIC EXPERIMENTS OF THE STRUCTURE OF THE SECONDARY SHIELDING FOR THE MARINE NUCLEAR REACTOR. (Nuclear-Powered Ship Research Assn. of Japan, Tokyo). Dec. 1, 1960. 64p. In Japanese.

From the viewpoint of construction, an investigation was made by dynamic experiments of the structure of the secondary shielding for the marine nuclear reactor. The test piece was a model of a part of the construction of the secondary shielding mounted outside and inside of the containment vessel of N.S. Savannah. The test pieces were vibrated more than 2 g at room temperature, and up to 0.28 g under elevated temperatures. The result showed that these test pieces are so secure that no additional consideration is necessary for them as far as the conditions under which they were tested. (auth)

26959 (RTI/ING(63)-4) STUDIO SPERIMENTALE SU MODELLI DI CARENE SOTTOMARINE PER UNA NAVE CISTERNA A PROPULSIONE NUCLEARE. (An Experimental Study on Models of Submarine Hulls for a Nuclear-Powered Tanker). E. Castagneto, F. Spinelli, and C. Coppola (Italy. Comitato Nazionale per l'Energie Nucleare, Rome). May 1963. 44p.

Studies were made on models of submarine hulls, designed for the transportation of liquid cargos, in order to explore, with towing and self-propelled tests, the penetration capacity at high velocity and total immersion of various hulls as a function of the hull form and dimensions. The studies were referred to a submarine tanker of 50,000 tons total displacement in complete immersion. The results of the tank tests for five hull models are given in tabular and graphic form and discussed in some detail. (J.S.R.)

26960 NUCLEAR PROPULSION FOR NAVAL VESSELS. D. J. Higson (Atomic Energy Commission, Australia). At. Energy Australia, 7: No. 2, 2-9(Apr. 1964).

The advantages and economics of nuclear-powered naval vessels are discussed. It appears that the increased effectiveness of nuclear-powered submarines and major surface vessels far outweighs the additional cost. (auth)

26961 MOUNTING DEVICE FOR FUEL ELEMENT ASSEMBLIES IN A NUCLEAR REACTOR. Claude Hespel and Joseph Olivier (to Commissariat à l'Energie Atomique). U. S. Patent 3,134,722. May 26, 1964. Priority date Oct. 3, 1961, France.

A mounting device for fuel element assemblies in a pressurized water reactor for marine propulsion, is designed which provides rigidity while allowing free expansion. The device comprises a head and a cylindrical guide tube. The head is located in a recess in the upper grid of the reactor, and the guide tube moves pawls into contact with the lower edge of the recess. Expansion is by means of a ferrule located in a recess in the lower grid. (D.L.C.)

Research and Test Reactors

26962 (ORNL-3572) THE HIGH FLUX ISOTOPE REACTOR. VOLUME 1. A FUNCTIONAL DESCRIPTION. F. T. Binford and E. N. Cramer, eds. (Oak Ridge National Lab., Tenn.). May 1964. Contract W-7405-eng-26. 378p.

A description of the High-Flux Isotope Reactor (HFIR) intended to serve the twofold purpose of presenting a reasonably comprehensive picture of the system as a basis for other more specialized studies and of providing the necessary background material for the "Safety Analysis," which will appear as ORNL-3573, is given. The description reflects the design as it was about January 1964, at which time, although construction was approximately 80% complete, certain of the design features had not been made final. Because of this it is likely that some changes will occur prior to completion. It is planned to publish, following completion of construction, a supplementary volume incorporating these changes. However, at this time, it does not appear probable that there will be any extensive modifications. Volume I is basically descriptive in nature and is for the purpose of acquainting the reader with just what the HFIR is and how it operates. Except where necessary for clarity, little emphasis is placed on the design calculations. A list of HFIR reports, which constitute the detailed basis for the design, is given. The various operating parameters cited are design numbers only, and the actual values may differ from them to some extent. The values of these parameters

will be known with a high degree of certainty only after the system has been tested under actual operating conditions. Volume II contains a selected group of HFIR design drawings which, if used in conjunction with text and figures in Vol. I, will materially aid in gaining an understanding of the system. (auth)

26963 (KFK-tr-139) BESCHREIBUNG EINER TIEF-TEMPERATUR-BESTRAHLUNGS EINRICHTUNG IM REAKTOR. (Description of a Low Temperature-Irradiation Arrangement in Reactor). Translated into German by Peter Buriks (Kernforschungszentrum, Karlsruhe, Ger.), from publication 532-62-2 of the Japanese Nuclear Research Center. [nd]. 15p.

A low-temperature irradiation installation in the Japanese Research Reactor-3 for investigation of neutron-induced radiation damage in crystalline solids is described. In it the sample can be irradiated at the temperature of liquid helium (–296°C). The primary cooling system, the irradiation chamber plug, the fast converter, the cooling system of the fast converter, the arrangement for insertion and removal of the sample, the shielding, measuring and control systems, auxiliary equipment, and construction and assembly are described. (M.C.G.)

26964 THE ELECTRONIC INSTRUMENTATION FOR CONTROL AND PROTECTION OF THE FAST REACTOR BR-1, USED FOR PHYSICS RESEARCH. Yu. A. Blyumkina. At. Energ. (USSR), 16: 250-1(Mar. 1964). (In Russian)

Electronic instrumentation of the control and protection system of a zero-power reactor must be very sensitive even at low neutron-flux levels because the short lifetime, about 10^{-8} to 10^{-7} sec, of the prompt neutrons requires very fast reaction. For this reason, pulsed electronic instrumentation was used in conjunction with sensitive detectors, such as BF_3-filled proportional counters in a paraffin moderator. In order to increase the reliability of the system, three independent channels were included in the design; two of them are to be used for emergency control and the third for power-level control. The supply system was electronically stabilized. The proportional counters and the preamplifiers with an amplification of about 30 were placed in the reactor building while the main amplifier was mounted on the control panel. The required accuracy could be easily achieved in the measurement of the time constant. In order to increase the speed of the system, intermediate relays were excluded and the electromagnets of the emergency systems were supplied directly through contacts acting within 1.5 to 2 msec. The whole unit was operated successfully for 8 years in the BR-1 fast reactor and for several years in the startup system of the BR-5 reactor. (TTT)

26965 LABORATORY EXPERIMENTS AT THE HIGH FLUX REACTOR. J. A. Goedkoop. Atoomenergie Haar Toepassingen, 6: 23-9(Feb. 1964). (In Dutch)

The experiments designed for student laboratory exercises at the High Flux Reactor are described. These are photography of scattered neutrons, scattering of neutrons by a rotating disk, and magnetic scattering of neutrons. (tr-auth)

26966 PLANNING OF RESEARCH WITH A NUCLEAR REACTOR. F. E. Prieto (Universidad Nacional de Mexico, Mexico City). Com. Nacl. Energia Nucl. (Mex.), [Publ.], No. 124, 21-32(Aug. 1963). (In Spanish)

A brief indication is given of the planning necessary in a research reactor program. As an introduction, the functioning of a reactor is outlined. The utilization of a research reactor, personnel training, possible areas of study, cooperative investigations with outside groups, and general applications of a reactor are the topics discussed. (J.S.R.)

26967 NEUTRON FLUX MEASUREMENT AT THE HIGH-TEMPERATURE REACTOR BBC/KRUPP. B. Wolfram (Brown Boveri/KRUPP Reaktorbau GmbH, Mannheim, Ger.). Kerntechnik, 6: 165-6(Apr. 1964). (In German)

Methods of measuring neutron flux in the BBC/KRUPP reactor and suppressing disturbing effects are described. It was found that good shielding must be provided for the wires from the detector to the first amplifier and that disturbances in the measurements from the electric power supply must be prevented. (M.C.G.)

26968 SAFETY SYSTEM FOR THE CONTROL OF NEUTRON FLUX AT THE HIGH-TEMPERATURE REACTOR BBC/KRUPP. B. Wolfram (Brown Boveri/KRUPP Reaktorbau GmbH, Mannheim, Ger.). Kerntechnik, 6: 166-7(Apr. 1964). (In German)

Neutron flux measurements for the BBC/KRUPP Reactor were so regulated that at anything larger than a certain set amount a safety signal is produced. Uses of relays and semiconductors in the safety system are described. The role of the computer in deciding to shutdown the reactor is outlined. (M.C.G.)

26969 PROSPECTS FOR THE VULCAIN REACTOR. Pierre E. Maldague. New Scientist, 22: 536-7(May 28, 1964).

The Vulcain, a compact, pressurized-water reactor, conceived in Belgium and developed in collaboration with the UK Atomic Energy Authority is favored in studies of nuclear ship possibilities. While Britain decides whether to build a ship, Belgium is going ahead with a prototype Vulcain power station. (auth)

26970 POWER-SPECTRAL-DENSITY MEASUREMENTS IN A SUBCRITICAL NUCLEAR REACTOR. Ronald W. Badgley and Robert E. Uhrig (Univ. of Florida, Gainesville). Nucl. Sci. Eng., 19: 158-63(June 1964).

The power spectral density of the neutron density of a reactor is frequency dependent and related to the reactor transfer function and the power spectral density of the input disturbance. For a critical reactor, a power-spectral-density measurement can be used to evaluate the ratio (β/l) where β is the effective delayed-neutron fraction and l the effective neutron lifetime. For subcritical operation, an evaluation of the reactor shutdown margin can be obtained by determining the quantity $\alpha = (1-k(1-\beta)/l)$ where k, the effective reproduction constant, can be determined if the effective neutron lifetime and effective delayed neutron fraction are known. The output power spectral density of a reactor, operating in the subcritical region, was measured using a plutonium/beryllium source to provide the input disturbance. The data are then fitted by a least-squares method to a theoretical model to obtain the quantity $(1-k(1-\beta)/l)$. (auth)

26971 RANDOM NOISE ANALYSIS IN THE IOWA STATE UNIVERSITY UTR-10 REACTOR. Richard Arlen Danofsky. Thesis, Ames, Iowa, Iowa State Univ. of Science and Tech., 1963. 88p.

An investigation was conducted to study the crosscorrelation and cross power spectral density functions of the neutron density fluctuations in the two fuel regions of the Iowa State University UTR-10 reactor which is a modified, commercial version of the Argonaut reactor. The core of the UTR-10 consists of two sub-cores 5 in. by 20 in. by 24 in. high, each containing approximately 72 MTR-type fuel plates. The two fuel regions are surrounded by graphite and separated by approximately 18 inches. Due to this

arrangement, semi-independent behavior of the two sub-cores is possible. A generalized matrix formulation of the cross power spectral density function between any two of the observable variables in a system having multiple noise input functions is formally reviewed. The general relationship is used to derive an expression for the cross power spectral density function between the neutron fluctuations in the coupled sub-cores of the UTR-10. The derived relationship, which is valid for frequencies greater than one radian per second, is $\Lambda_{13}(\omega) = [k^1/(\omega^2 + \omega_1^2)(\omega^2 + \omega_2^2)]$ where; $\Lambda_{13}(\omega)$ is the cross power spectral density function, ω is angular frequency, radians/second, k^1 is a constant, $\omega_1 = \beta/l_0$, seconds^{-1}, $\omega_2 = 2\epsilon_0/l_0 + \beta/l_0$, seconds^{-1}, is the prompt neutron lifetime, seconds, ϵ_0 is the reactivity coupling coefficient between the two sub-cores and accounts for the reactivity interaction between them. The crosscorrelation function was measured and Fourier transformed to obtain the cross power spectral density function. The experimental data were compared with Equation 1 and the best estimates of l_0 and ϵ_0, in the least square sense, were obtained. The prompt neutron lifetime was determined to be 3.04×10^{-4} seconds, and the reactivity coupling between regions was found to be 5.17×10^{-13}. Since ϵ_0 is small, the two sub-cores are quite loosely coupled, that is, k_{eff} for each region is approximately unity when the two core system is critical. The neutron fluctuations in the two sub-cores were measured by BF_3 detectors operated as ion chambers, converted to voltage fluctuations and displayed on a dual beam oscilloscope, and recorded on 35-mm movie film. Timing dots were produced on the film by means of a neon bulb attached to the CRT face. The two traces on the developed film were sampled simultaneously at time intervals of $^1/_{120}$ second for a total sampling time of approximately 10 seconds. The correlation and power spectral functions were calculated by means of an IBM 7074. The Fortran statements for these calculations are presented. (Dissertation Abstr.)

26972 IMPROVEMENTS IN OR RELATING TO EXPERIMENTAL HETEROGENEOUS NUCLEAR REACTORS. (to Siemens-Schuckertwerke AG). British Patent 957,791. May 13, 1964. Priority date Aug. 27, 1959, Germany.

A test reactor is designed for neutron physics studies of power reactor lattices in the development stage. The reactor comprises an inner zone of a number of lattice cells being tested and an outer zone surrounding the inner zone and containing a number of moveable fuel elements and a moderator substance. The neutron spectrum and distribution may be adjusted simply by moving the fuel elements either inward or outward. (D.L.C.)

26973 HYDRAULIC SAMPLE CHANGER FOR TANK-TYPE WATER-COOLED NUCLEAR REACTORS. George P. Arnold, F. D. Newcom, P. D. O'Brien, and W. D. Schafer (to U. S. Atomic Energy Commission). U. S. Patent 3,136,697. June 9, 1964.

A nuclear reactor sample changer is designed with a hydraulically actuated sample transporting tube extending from outside the reactor to the inside of the reactor and into the core, a rotary magazine having a plurality of compartments intercepting an outside portion of the tube to enable all of the samples in the tube to be separately stored in the magazine chambers, and means for removing desired samples from the magazine and restoring the remaining samples back into the core. (AEC)

WASTE DISPOSAL AND PROCESSING

Refer also to abstract 25723.

26974 (BNL-853) DECONTAMINATION OF SAVANNAH RIVER WASTE SUPERNATE BY ION EXCHANGE. H. Katz and M. Rothbart (Brookhaven National Lab., Upton, N. Y.). Feb. 1964. Contract AT-30-2-GEN-16. 21p.

A flow sheet was developed for the decontamination of Savannah River waste supernate by ion exchange, using Linde AW 400 molecular sieves. Satisfactory decontamination from cesium and strontium could be achieved with this material, the activity in the effluent being mainly ^{106}Ru. The presence of potassium in the waste seriously decreased the cesium capacity of all ion exchange materials studied. Linde AW 400 molecular sieve was the only material investigated having sufficient capacity in the presence of 0.05 molar potassium to be of practical consideration. The cesium capacity was not affected by the ionic composition of the waste except for sodium and potassium. In order to prevent chemical attack of Linde AW 400 molecular sieve by highly alkaline wastes, sodium aluminate must be added to the waste to a concentration of at least 0.04 molar. In order to prevent precipitation of sodium aluminate on the resin after the elution portion of the cycle, an ammonia rinse is necessary prior to the introduction of fresh waste. The proposed flow sheet was demonstrated both with simulated waste on a tracer level and with actual high-level waste supernate in hot cell experiments. Results indicated no difference between simulated and actual waste solutions. (auth)

26975 (HW-72335(Pt.2)) STEADY DARCIAN TRANSPORT OF FLUIDS IN HETEROGENEOUS PARTIALLY SATURATED POROUS MEDIA. PART 2. THE COMPUTER PROGRAM. A. E. Reisenauer, R. W. Nelson, and C. N. Knudsen (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 1963. Contract AT (45-1)-1350. 84p.

The computer program, "Steady Darcian Flow in Soils," provides a means of obtaining numerical solutions to problems in the general class involving steady flow through porous media. Based on the mathematical and numerical treatment presented previously, the program was designed to handle the widest possible variety of boundary conditions. Potential distributions in saturated and partially-saturated, homogeneous or heterogeneous soils may be obtained. Combined saturated and partially-saturated flow cases may also be solved, since the equations used for one part are reducible to solve the other. Such a solution proceeds smoothly with little concern for the water table position which can be located easily in the problem solution. Moisture contents may be obtained from the results. The program was written for the IBM 7090 in FORTRAN and FAP languages. It can solve one-, two-, and three-dimensional and axisymmetrical problems with up to 8000 grid points. As many as 15 different soils may be included in a heterogeneous, partially-saturated flow problem. Optimum underrelaxation and overrelaxation techniques are used to increase the speed of convergence and to maintain stability. Other methods of maintaining stability are also discussed. (auth)

26976 (HW-80848) THERMAL CONSEQUENCES OF LEAKS IN RADIOACTIVE WASTE STORAGE TANKS. G. Jansen, Jr. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 2, 1964. Contract AT(45-1)-1350. 12p.

An analytical solution for determining the consequences of the leak of radioactive heat-generating solutions from storage tanks into soil was developed. As an example problem the case of a leak of Purex 241-A supernate containing 5×10^{-4}M cesium (0.18 Btu/hr/gal) was considered. The calculations indicated that for a leak of 5000 gallons the maximum steady-state rises encountered are 14 and 62°F at the concrete-soil interface and in the soil at a point 4.2 feet from the concrete liner, respectively. For a 50,000 gallon leak comparable temperature rises are 29 and 301°F, the latter at a point 10 feet from the concrete. It was concluded that even relatively large supernate leaks from the Purex waste storage tanks do not constitute a thermal hazard. A correlation is presented, which allows the calculation of maximum steady state temperatures for hemispherical leaks of solutions containing fission products of varying activity and adsorbability on the soil. The method of solving this problem is presented and it may be useful in determining temperature distributions near tanks, pipes, and other radioactive waste solution sources in the ground. (auth)

26977 (IDO-14620) ICPP WASTE CALCINING FACILITY SAFETY ANALYSIS REPORT. L. T. Lakey and J. R. Bower, eds. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Dec. 1, 1963. Contract AT(10-1)-205. 342p.

A study was made of the radiological hazards associated with operation of the ICPP Waste Calcining Facility. In addition to the normal release of small amounts of radioactivity with the process off-gas, possible accidental releases of larger amounts of radioactivity through operational error or equipment failure were examined. Bypassing of off-gas cleaning elements, uncontrolled chemical reactions, overheating by fission product heat, corrosion, abrasion, vibration, overpressure, utility failures, and major catastrophes were studied as possible causes of accidental radioactivity releases. No major safety deficiencies were found, and the facility appeared satisfactory for processing of high-level radioactive wastes. Details of the safety analysis and information on the process, equipment, and operation procedures are furnished. (auth)

26978 (ORNL-TM-857) STATUS OF THE ORNL POTCAL AND POTGLASS PROCESSES FOR THE CONVERSION OF HIGHLY RADIOACTIVE LIQUID WASTES TO SOLIDS. R. E. Blanco, J. O. Blomeke, W. E. Clark, E. J. Frederick, H. W. Godbee, C. W. Hancher, J. M. Holmes, and J. C. Suddath (Oak Ridge National Lab., Tenn.). May 8, 1964. Contract W-7405-eng-26. 38p.

The POTCAL (pot calcination) and POTGLASS (fixation of wastes in glassy solids) processes for conversion of highly radioactive wastes to solids are being developed. Economic and safety analysis of the processes were made. The equipment is described and corrosion problems discussed. (M.C.G.)

26979 TECHNOLOGY OF RADIOACTIVE WASTE MANAGEMENT AVOIDING ENVIRONMENTAL DISPOSAL. Report of a Panel Held in Vienna, February 12-16, 1962. (International Atomic Energy Agency, Vienna). Technical Reports Series No. 27. 1964. 151p. (STI/DOC/10/27). $3.00; Sch 63,-; 18s.stg; F.fr.12,-; DM 10.50 (IAEA).

The present radioactive waste management practice is related to total containment. Studies were made to determine how closely total containment might be approached using present technology and to assess the effects of research and development work underway. Topics covered include: collection and segregation, treatment and storage, and research and development. Both theory and operational experience are considered. (48 references). (M.C.G.)

26980 IMPROVEMENTS IN OR RELATING TO THE MANUFACTURE OF PRODUCTS CONTAINING RADIOACTIVE MATERIALS. Guy Lefillatre, Jean Rodier, and Jean Scheidhauer (to Commissariat à l'Energie Atomique). British Patent 959,751. June 3, 1964. Priority date Dec. 6, 1961, France.

A process is given for the production of solid products containing radioactive wastes. The process comprises mixing an aqueous radioactive mud with a fluidified bitumen in the presence of a wetting agent to eliminate water, mixing the resulting bituminous mastic containing the mud solids in coated form, and pouring the mastic to form solid plastic blocks. Before mixing, the mastic may be heated to 100°C to distill off completely the residual water. Several examples of the process are given. (D.L.C.)

GENERAL AND MISCELLANEOUS

26981 (HW-68600-38) PLUTONIUM ABSTRACTS. VOLUME 4, NO. 4. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 1, 1964. Contract AT(45-1)-1350. 29p.

Abstracts of papers on developments in all areas of plutonium technology are presented. The abstracts are grouped under the following topics: biology and medicine, chemistry, metallurgy and ceramics, physics, reactor technology, and miscellaneous. (M.C.G.)

26982 (NYO-2462-1) DIGITAL COMPUTER ANALYSIS OF TISSUE CELL GROWTH. Final Contract Report, August 15, 1962–January 31, 1964. Joseph G. Hoffman (New York. State Univ., Buffalo). May 26, 1964. Contract AT(30-1)-2462. 5p.

A model of cell multiplication is presented in which the intermitotic times are randomly variable. The various kinds of volume growth of the cell during the intermitotic time were introduced. This model of growth was set up for application to cells having only the diploid compliment of chromosomes and subject to binary fission. The results are of general applicability and may be applied to any one cell moiety such as nuclear volume or cytoplasmic volume provided all cells are identical as defined by the parameters of the life cycle and by the volume growth law. The results of this model were applied to the mouse ascites tumor cell data on the TA3 tumor because its ploidy was known. The model was refined to take into account the removal of cells in stationary and in growing populations. A further step was completed in the construction of populations having any desired composition of chromosomal ploidy. (auth)

26983 (NYO-2734-1) ENERGETICS TRANSFER IN THE PHOTODYNAMIC REACTION. Final Report. Leonida Santamaria (Milan. Università. Istituto di Patologia Generale). Apr. 1964. Contract AT(30-1)-2734. 80p.

A list of the photodynamic substances is presented to demonstrate that the photodynamic effect is a phenomenon brought about by a high number of chemicals with a great variety in chemical structure. The criteria adopted for finding a common characteristic among them were of biological, biochemical, chemical, or physico-chemical nature. The biological and biochemical approaches proved that it is difficult to have a homogeneity of response using different substrates. This gave support to the theory that photodynamic substances operate on definite interactions (possibly of London-Van der Waals type) with the substrate. This also indicated the necessity of using different tests for a group of sensitizers or different sensitizers in the study of the photodynamic lesion of a particular substrate. The application of such principles was fruitful in the study of furocoumarin, polycyclic hydrocarbons, phenothiazines, and other substances. From these investigations the main conclusions were: for furocoumarins, it is possible to indicate a correlation between chemical structure and activity; for polycyclic hydrocarbons, additional data support the theory that photodynamic action is important as an aspect of the carcinogenic activity; and for phenothiazines, the data indicate some correlation between chemical structure and activity. Studies on the mechanism of action proved the oxygen dependence of the reaction. In this connection, the most important facts were the postulation of a "photoperoxide" and the demonstration of such a metastable compound in an "oxyradical" detected by electron-spin-resonance techniques. In the case of furocoumarins, however, it was found that oxygen is not necessary to the reaction. Data regarding the necessity of a complex formation between sensitizer and substrate seemed to prove that in some particular cases such a combination is not evident. Studies regarding the importance of fluorescence, phosphorescence, and photoreducibility of the sensitizers demonstrated that only those dyes that are photoreducible (and which, therefore, are able to form dye molecules in the long-lived excited state) can act as photosensitizers in photo-oxidation. Photo-oxidation was found to involve the participation of molecules in the long-lived state. The significance of the photodynamic reaction in general pathology as well as in physiology was apparent in observations on natural photodynamic sensitivity in cells and tissues, such as sperms, retina, ascitic tumor cells, and worms. This indicated that natural photodynamic systems are present in normal as well as pathological cells. It was clear, from the clinical data, that the introduction of photodynamic agents in human and animal organisms produces, under light, skin diseases with a variety of syndromes. The information available does not permit a satisfactory pathogenetic classification to be proposed. (auth)

26984 (TEI-826) GEOLOGIC MAP OF THE PAIUTE RIDGE QUADRANGLE, NYE AND LINCOLN COUNTIES, NEVADA. F. M. Byers, Jr., and Harley Barnes (Geological Survey, Washington, D. C.). June 1964. 13p.

26985 (TEI-845) GEOLOGIC MAP OF SKULL MOUNTAIN QUADRANGLE AT THE NEVADA TEST SITE, NYE COUNTY, NEVADA. E. B. Ekren and K. A. Sargent (Geological Survey, Washington, D. C.). May 1964. 16p.

26986 (TEI-846) GEOLOGIC MAP OF THE TOPOPAH SPRING SW QUADRANGLE, NEVADA. P. W. Lipman and Edward J. McKay (Geological Survey, Washington, D. C.). May 1964. 14p.

26987 (TID-4100(Suppl.21)) SUPPLEMENTAL INSERT SHEETS FOR ENGINEERING MATERIALS LIST. Richard E. C. Duthie, ed. (Division of Technical Information Extension, AEC). May 1964. 47p.

Included are lists under computers, engineering equipment, hot-laboratory equipment, instruments, nuclear radiation instruments, nuclear reactors and reactor facilities, chemical plant design and processes, biological research equipment, rockets and missiles, and specifications for thermocouples and refractories. The CAPE packages were previously abstracted for NSA (18: 5679, 12297, 12298, 12299, 12300, 12301, 12302, 12330, 12331, 12332, 13343, 13979, 16288, 17983, 17984, 17785, 17986, 17987, 17988, and 19288). (R.E.U.)

26988 (TID-20635) THE ROLE OF SERUM ERYTHROPOIETIC FACTOR IN ANEMIA OF MALIGNANCY. Theodore C. Prentice (Roswell Park Memorial Inst., Buffalo and New York. State Univ., Buffalo). [May 1964]. Contract AT(30-1)-1829. 13p.

Data are summarized from a series of studies on the role of blood erythropoietic factor in anemia associated with malignancy and various factors affecting erythropoietin levels in the blood of mice, rats, rabbits, monkeys, and anemic humans with varying disease processes. Attempts to purify and characterize erythropoietin are reported. Iron-59 was used as a tracer of erythropoietic activity in

a number of the studies. Data are included on the species specificity of erythropoietin and the effects of hypoxia, hypophysectomy, nephrectomy, Co, hemorrhage, reticuloendothelial system block, virus infections, and genetic factors on erythropoietin content of blood. (C.H.)

26989 (AEC-tr-6227/1) BULLETIN OF THE BORIS KIDRIČ INSTITUTE OF NUCLEAR SCIENCES. Translation of Bilten Instituta za Nuklearne Nauke "Boris Kidrič", 15: No. 1, 1-49(1964). 55p.

A translation of the Bulletin of the Boris Kidrich Institute of Nuclear Sciences, Vol. 15, No. 1, 1964 is presented. Separate abstracts were prepared for each of the 5 papers included. (M.C.G.)

For abstracts of individual papers see: 25215, 25273, 25611, 26710, and 26865.

26990 (JPRS-23767) TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 75. Mar. 19, 1964. 82p. (OTS-64-21840)

Translations are presented of ten selected articles which treat respectively a visit to Peking University, gas centrifugal separation of isotopes, pulse laser, ruby absorption spectrum, iodine heterocyclic compounds, decomposition, of boron phosphide, charged particle motion in dipole magnetic fields, survey of the Mount Everest region, material transport models, and Chinese medicine. Separate abstracts were prepared for two articles dealing with gas centrifugal separation and charged-particle motion in magnetic fields. (D.L.C.)

For abstracts of individual papers see: 25878 and 26117.

26991 THE PHOTOGRAPHY OF RADIOACTIVE MATERIALS. J. C. J. Stewart (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Phot. Sci., 11: 279-87(1963).

Problems peculiar to the photography of radioactive materials are discussed. Specialized apparatus and techniques are described, such as telephotography via mirrors, illumination systems, and macro techniques. (auth)

26992 PROGRESS OF INDUSTRIAL DEVELOPMENT. Kerntechnik, 6: 178-9(Apr. 1964). (In German)

Developments in instrumentation and measurement, electronics, special-purpose reactors, materials, waste disposal, and applied radiation are discussed. (M.C.G.)

26993 SOME ECONOMIC IMPLICATIONS OF NUCLEAR POWER GENERATION IN LARGE CENTRAL STATIONS. W. D. Shipman. Land Econ., 40: 1-17(Feb. 1964).

The significance of the scale economics derived from supply system expansion in making real cost comparisons of nuclear and conventional power generation is stressed. It is estimated that by the end of the century between ⅓ and ½ of the U. S. installed capacity will be nuclear, with a strong trend toward breeder reactors. By 1970 capital costs can be brought to within 5% or less of conventional stations. Assessed capital and generating costs of the proposed Bodega Bay, San Onofre, Los Angeles, and Connecticut Yankee nuclear stations are given; total energy costs will be between 6 and 7 mills/kwh. Second core operating costs at Dresden and Yankee are expected to drop to 4 mills/kwh. The effects of expansion in nuclear power generation on utility system organization, the fuel economy, tariffs and labor are discussed. (auth)

26994 PORT STRUCTURE FOR X-RAY DEVICES. William W. Fengler (to Machlett Labs., Inc.). U. S. Patent 3,134,903. May 26, 1964. Filed Apr. 28, 1961.

A port structure is designed for x-ray tube housings. The port structure has an aperture and is coated with an x-ray-opaque material. The aperture is shaped to allow a rectangular beam to pass through, and means is provided for adding filters. (D.L.C.)

26995 FIRE-RESISTING CONTAINERS. George Henry Bulmer (to United Kingdom Atomic Energy Authority). U. S. Patent 3,135,419. June 2, 1964. Priority date May 5, 1961, Great Britain.

A container lined with a solid fused layer of a fire extinguishing agent based on a mixture of inorganic salts is described. The layer is separated from the free interior space of the container by a membrane collapsible by heat. (C.E.S)

26996 ELECTRICAL CONNECTOR GROUNDING APPARATUS. E. F. Ehrman and F. J. Sparber (to U. S. Atomic Energy Commission). U. S. Patent 3,136,593. June 9, 1964.

A grounding structure for electrical connectors is designed which is capable of preventing undesirable discharge occurring through the contacting elements of a connector during connector coupling. The grounding structure comprises a plurality of flexible projection carrying segments disposed about the periphery of a connector shell with the projections being oriented to engage a leading surface on a mating connector portion prior to the establishment of an electrical path through the connector contacting elements. (AEC)

26997 D.C. INSTRUMENT TRANSFORMER SYSTEM. Alfred A. Windsor (to U. S. Atomic Energy Commission). U. S. Patent 3,136,948. June 9, 1964.

An instrument is designed for facilitating the measurement of large direct currents. The toroidal cores of two saturable transformers are disposed around a conductor carrying the current to be measured and the secondary windings of the transformers are connected in series. An alternating current source is utilized to cause the transformer cores to alternately unsaturate so that the output of the circuit is a steady state voltage having an amplitude corresponding to the magnitude of the primary conductor current. No filtering is required and therefore the output voltage responds instantly to primary current changes. Accuracy of the device is not affected by extraneous magnetic fields. (AEC)

26998 FLUID METERING DEVICE. Leroy R. Hawk and Virgil E. Scribner (to U. S. Atomic Energy Commission). U. S. Patent 3,137,174. June 16, 1964.

A pneumatically actuated fluid metering device is designed for accurately injecting small volumes of a fluid into a process stream. The metering device comprises two adjacent fluid chambers separated by a self-sealing septum. The fluid to be injected is contained within one of the chambers, and the process stream flows through the other. A pneumatically actuated hypodermic syringe reciprocates between the two chambers through the septum, thereby transferring measured volumes of the injection fluid into the process stream. (AEC)

26999 ULTRA HIGH VACUUM DEVICE. J. T. Mark (to U. S. Atomic Energy Commission). U. S. Patent 3,137,551. June 16, 1964.

An improved high vacuum liquid nitrogen trap is described. The trap comprises a cooling tank through which the gas is transferred to form the vacuum and means supporting this tank which forms a vacuum chamber surrounding the tank, which effectively isolates the cooling tank from its surrounding member, maintains the tank at

a constant low temperature for long periods of time, and avoids the problem of variable cooling tank temperatures known heretofore. The structure also offers minimum impedance in the pumping system, prevents the migration of molecules from the low to high vacuum regions, and provides minimum cooling fluid consumption. (AEC)

27000 CAPACITOR WITH AN INTERNAL GAS BARRIER. E. L. Ford and R. E. Hampy (to U. S. Atomic Energy Commission). U. S. Patent 3,138,652. June 23, 1964.

An electrical capacitor is designed in which a gas barrier inside the capacitor forms a gas retaining pocket. The barrier material is yieldable to absorb or damp fluid pressure changes and is "wetted" by the capacitor liquid to render it impervious to the gas but not to the liquid, thus enabling the liquid to expand or contract without straining the capacitor shell or affecting the disposition of the confined gas. (AEC)

27001 INSPECTABLE SOLDERING FLUX COMPOSITION. G. Voida (to U. S. Atomic Energy Commission). U. S. Patent 3,139,360. June 30, 1964.

Soldering flux compositions are described whose presence in trace amounts on soldered surfaces is readily detectable under ultraviolet light. Fluxing compositions, which typically consist of fluxing agents, solvents, activators, and wetting agents, may have homogeneously incorporated therein about 0.1 to 0.5 weight percent of a chemically and thermally stable ultraviolet light absorbing material. (AEC)

CORPORATE AUTHOR INDEX

This index contains entries for this period for all report literature and, in addition, for certain published literature items for which it is felt that a corporate approach is especially desirable, e.g., symposia, conference proceedings, and meetings.

Each entry under a corporate author is a shortened version of the title of the publication, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt.," permitting a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

A

AKTIEBOLAGET ATOMENERGI, STOCKHOLM.
Bibliography on determination of trace amounts of Cd, Cr, Co, Fe, Mn, and Mo in U, 18: 25272 (VDDIT-90)
Bibliography on radiation effects on solid, U-based nuclear fuel materials, 18: 26072 (VDDIT-16(4.2))
Bibliography on transportation of radioactive materials, 18: 25713 (VDDIT-89)
Radiolysis of aqueous benzene solutions, 18: 25464 (AE-142)

ALBERTA. UNIV., EDMONTON.
Identification of charged particles with solid-state detector, 18: 25794 (NAS-NRC-Pub-1184(p.96-103))
Multidimensional kicksorter using magnetic-tape storage, 18: 25824 (NAS-NRC-Pub-1184(p.305-12))

ALLIS-CHALMERS MFG. CO. ATOMIC ENERGY DIV., BETHESDA, MD.
Fabrication of collapse clad for Pathfinder, 18: 26914 (ACNP-63031)

AMELCO SEMICONDUCTOR. DIV. OF TELEDYNE, INC., MOUNTAIN VIEW, CALIF.
Effects of irradiation on field effect and injection transistors, 18: 25741 (N64-13163)

AMERICAN ELECTRIC POWER SERVICE CORP., NEW YORK.
Technical feasibility and energy costs, 18: 26926 (TID-20605)

AMES LAB., AMES, IOWA.
Crystallographic lattice type and cell constants, 18: 26108 (IS-839)

ARGENTINA. COMISIÓN NACIONAL DE ENERGÍA ATÓMICA, BUENOS AIRES.
Existence of diprotons using reaction $He^3(d,t)He^3$, 18: 26533 (NP-13974)
Obtaining of Pu tracer in synchrocyclotron, 18: 26169 (NP-13973)

ARGONNE NATIONAL LAB., ILL.
Alloy fuels and jacket materials, 18: 25966 (ANL-6868(p.120-32))
Alloying properties, 18: 25970 (ANL-6868(p.303-25))
BORAX-V superheat fuel elements, 18: 26894 (ANL-6868(p.109-16))
Ceramic fuels and high absorbing materials, 18: 26896 (ANL-6868 (p.133-74))
Ceramic materials research, 18: 25893 (ANL-6868(p.355-72))
Corrosion research, 18: 25920 (ANL-6868(p.338-54))
Corrosion-resistant jacketing and structural materials, 18: 25919 (ANL-6868(p.190-200))
Diffusion studies, 18: 25969 (ANL-6868(p.287-302))
Electromagnetic system applied to inspection of thin-walled tubing, 18: 25674 (ANL-6728)
Fabrication methods, 18: 25939 (ANL-6868(p.201-18))
Fast reactor fuel, 18: 26893 (ANL-6868(p.11-108))
Full-scale reactor fuel elements, 18: 26898 (ANL-6868(p.188-9))
Information processing systems at Argonne, 18: 25744 (NAS-NRC-Pub-1184(p.38-9))
Irradiation effects, 18: 26069 (ANL-6868(p.373-417))
Irradiation of fuel and control materials, 18: 26897 (ANL-6868(p.175-87))
Isotope production as by product in fast power reactors, 18: 26927 (TID-20647)
Metallurgy of Pu, 18: 25892 (ANL-6868(p.234-66))
Metallurgy of Ti, Zr, and Hf, 18: 25968 (ANL-6868(p.267-86))
Metallurgy of U, 18: 25967 (ANL-6868(p.231-3))
Neutron radiographic inspection of irradiated specimens, 18: 26068 (ANL-6799)
Nondestructive testing methods, 18: 25675 (ANL-6868(p.219-28))
Nuclear cross section measurements, 18: 26559 (WASH-1047)
Nuclear magnetic resonance and magnetic susceptibility, 18: 26522 (ANL-6868(p.326-30))
Plutonium recycle fuel and control rods, 18: 26895 (ANL-6868(p.117-19))
Prog. rpt. on metallurgy, annual, 1963, 18: 25891 (ANL-6868)
Prog. rpt. on reactor development, 4/64, 18: 26824 (ANL-6885)
Spark chamber pulser for air-borne use, 18: 25828 (TID-20646)
X-ray- and neutron-diffraction studies, 18: 25971 (ANL-6868(p.331-7))

ARIZONA. UNIV., TUCSON.
Prog. rpt. on improvement of BWR stability, 1–4/64, 18: 26924 (EURAEC-1065)

ARMY MISSILE COMMAND, REDSTONE ARSENAL, ALA.
Theory for plasma-filled diodes, 18: 26250 (AD-423086)

ARMY NUCLEAR DEFENSE LAB., EDGEWOOD ARSENAL, MD.
Evaluation of internal radiac detector positions, 18: 25709 (NDL-TR-49)

ATOMIC ENERGY OF CANADA LTD., CHALK RIVER, ONT.
Digital stabilizing methods for multichannel analyzing systems, 18: 25804 (NAS-NRC-Pub-1184(p.150-64))
Exploiting the U–Th fission cycle, 18: 26917 (DM-72)
Extraction of Pu by hexone from aqueous solutions, 18: 25604 (CRC-487)
Information processing equipment for physics at Chalk River, 18: 25742 (NAS-NRC-Pub-1184(p.23-35))

ATOMIC ENERGY OF CANADA LTD. CHALK RIVER NUCLEAR LABS., CHALK RIVER, ONT.
Analog-to-digital converter, 18: 25809 (NAS-NRC-Pub-1184(p.180-3))
Time-shared computer for real-time information processing, 18: 25883 (NAS-NRC-Pub-1184(p.271-82))

ATOMIC ENERGY OF CANADA LTD. CHALK RIVER PROJECT, CHALK RIVER, ONT.
Extraction of Pu with triethylene glycol dichloride, 18: 25603 (CEI-18)

ATOMICS INTERNATIONAL. DIV. OF NORTH AMERICAN AVIATION, INC., CANOGA PARK, CALIF.
BOOMER—program for evaluating response of SNAP 2/10A, 18: 26957 (NAA-SR-8414)
Neutron scattering from C, Be, Al, Fe, and polyethylene, 18: 26532 (NAA-SR-9418)
Out-of-pile temperature evaluation of fission product retention in Na, 18: 25326 (NAA-SR-Memo-9383)
Prog. rpt. on radiation effects on electrode behavior, 6–8/63, 18: 26067 (AI-8971)
Prog. rpt. on solubility and diffusion of ultra-pure transition elements

12/29/63–3/28/64, 18: 25314 (AI-64-75)
Thermal properties of refractory materials, 18: 25986 (WADD-TR-60-581(Pt.IV))
AVCO CORP. AVCO-EVERETT RESEARCH LAB., EVERETT, MASS.
Electrode losses in MHD generators, 18: 26252 (BSD-TDR-64-35)
Wave growth and instability in partially ionized gases, 18: 26689 (BSD-TDR-64-34)

B

BABCOCK AND WILCOX CO., LYNCHBURG, VA.
Open-loop analog study, 18: 26825 (BAW-1228)
BATTELLE MEMORIAL INST., COLUMBUS, OHIO.
Fabrication of U and U-base alloy tubes and rods, 18: 25940 (BMI-X-294)
BATTELLE MEMORIAL INST. DEFENSE METALS INFORMATION CENTER, COLUMBUS, OHIO.
Cracking in high-strength steel weldments, 18: 25941 (DMIC-197)
BATTELLE MEMORIAL INST. INTERNATIONAL DIV., GENEVA.
Metals subjected to stress and irradiation, 18: 25974 (EURAEC-1037)
BELL TELEPHONE LABS., MURRAY HILL, N. J.
Excited states of He-4, 18: 26528 (BNL-7983)
Nuclear radiation recorder analyzer, 18: 25821 (NAS-NRC-Pub-1184 (p.255-65))
BOEING CO., SEATTLE.
Carrier lifetime in InSb high carrier densities, 18: 26106 (D1-82-0306)
Window problem in cylindrical geometry, 18: 26690 (D1-82-0217)
BOLOGNA. UNIVERSITÀ.
Fast transistorized amplifier with large dynamic range, 18: 25793 (NAS-NRC-Pub-1184(p.89-95))
Lifetime of ${}_{\Lambda}H^{3}$, 18: 26527 (BNL-837(p.454-6))
Multichannel transistorized pulse-height analyzer, 18: 25805 (NAS-NRC-Pub-1184(p.165-8))
BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Argonne-Chicago neutrino experiment at ZGS, 18: 26166 (BNL-837 (p.170-89))
Astrophysics and fundamental neutrino interactions, 18: 26187 (BNL-837(p.193-233))
Bibliography on bubble chambers, 18: 25778 (BNL-8083)
Capture rate for muons in He-4, 18: 26524 (BNL-837(p.309-13))
CERN neutrino beam, 18: 26165 (BNL-837(p-91-113))
CERN neutrino experiment, 18: 26266 (BNL-837(p.160-9))
Conference on weak interactions, Brookhaven, 9/63, 18: 26260 (BNL-837)
Conserved vector current theory in forbidden β transitions, 18: 26526 (BNL-837(p.340-3))
Decontamination of Savannah River waste supernate, 18: 26974 (BNL-853)
Effect of irradiation upon adsorption by alumina catalyst, 18: 25468 (BNL-845)
Excited states of He-4, 18: 26528 (BNL-7983)
Ferroelectric hysteresis bridge, 18: 25738 (BNL-8006)
Field-effect transistors in charge-sensitive amplifiers, 18: 25791 (NAS-NRC-Pub-1184(p.70-8))
Field theory of weak interactions, 18: 26267 (BNL-837(p.237-48))
GRAPE—computer program for classical many-body problems in radiation damage, 18: 26070 (BNL-7979)
Heavy liquid bubble chamber in CERN neutrino experiment, 18: 26265 (BNL-837(p.114-36))
Higher order leptonic weak interactions, 18: 26269 (BNL-837(p.257-65))
Information processing systems at Brookhaven, 18: 25743 (NAS-NRC-Pub-1184(p.36-7))
K_1^0 regeneration in hydrogen, 18: 26264 (BNL-837(p.82-7))
K_1–K_2 mass difference, 18: 26263 (BNL-837(p.74-81))
Leptonic decay of hyperons, 18: 26274 (BNL-837(p.355-77))
Leptonic decays in unitary symmetry scheme, 18: 26272 (BNL-837 (p.299-302))
Lifetime of K_1^0 mesons, 18: 26261 (BNL-837(p.42-52))
Models for interactions, 18: 26270 (BNL-837(p.266-74))
Multiple scattering corrections, 18: 26530 (BNL-8028)
Muon capture in complex nuclei, 18: 26523 (BNL-837(p.292-7))
Muon capture in hydrogen, 18: 26271 (BNL-837(p.277-91))
Pion beta decay, 18: 26273 (BNL-837(p.344-52))
Possible violation of $\Delta S = \Delta Q$, 18: 26262 (BNL-837(p.54-65))
Present status of Ξ decay, 18: 26275 (BNL-837(p.410-26))
Radiative muon capture in Ca-40, 18: 26525 (BNL-837(p.315-23))
Statistical theory of nuclear reactions, 18: 26529 (BNL-8020)
Theoretical considerations concerning neutrino experiments, 18: 26266 (BNL-837(p.249-56))
BRUSH DEVELOPMENT CO., CLEVELAND.
Prog. rpt. on Be wire, 2–4/64, 18: 25938 (AD-439498)
BUNEOS AIRES. UNIVERSIDAD.
Models for interactions, 18: 26270 (BNL-837(p.266-74))
BUREAU OF MINES, PITTSBURGH.
Electrodeposition of Mo from molten electrolytes, 18: 25316 (BM-RI-6455)
X rays scattered by polytype-crystalline materials, 18: 26104 (BM-RI-6455)

C

CALIFORNIA INST. OF TECH., PASADENA.
Prog. rpt. on radiation effects on electrode behavior, 6–8/63, 18: 26067 (AI-8971)
CALIFORNIA. UNIV., BERKELEY. LAWRENCE RADIATION LAB.
Direct 3-D display, 18: 25748 (NAS-NRC-Pub-1184(p.320-1))
Energy-mass distributions in induced fission, 18: 26558 (UCRL-11337)
Light flash generator for gain stabilization of photosensitive systems, 18: 25817 (NAS-NRC-Pub-1184(p.220-8))
Linear amplifier, gating and timing system, 18: 25799 (NAS-NRC-Pub-1184(p.124-34))
Low-noise pre-amplifier for use with semiconductor detectors, 18: 25800 (NAS-NRC-Pub-1184(p.61-4))
Multiparameter pulse-height recording system, 18: 25823 (NAS-NRC-Pub-1184(p.287-91))
Phototube noise rejection using pulse cross-over technique, 18: 25802 (NAS-NRC-Pub-1184(p.143-5))
Proton synchrotron for 150- to 300-Bev range, 18: 26170 (UCRL-10969)
"Ramp-pulser" for testing linearity of pulse-analysis systems, 18: 25816 (NAS-NRC-Pub-1184(p.216-19))
Series-parallel transistor switch as linear gate, 18: 25798 (NAS-NRC-Pub-1184(p.121-3))
Timing using semiconductor detectors, 18: 25788 (NAS-NRC-Pub-1184 (p.59-60))
CALIFORNIA. UNIV., DAVIS.
Effect of x irradiation on reproduction of female beagles, 18: 25091 (UCD-472-109(p.53-61))
Ophthalmoscopic findings in experimental dogs, 18: 25090 (UCD-472-109(p.45-8))
Pathology report on experimental beagles, 18: 25093 (UCD-472-109 (p.62-172))
Prog. rpt. on long-term effects of x radiation on beagle, annual, 1963, 18: 25088 (UCD-472-109)
Psychological field studies on irradiated adult female beagles, 18: 25095 (UCD-472-109(p.49-52))
Status of experimental [beagle] colony, 18: 25089 (UCD-472-109 (p.18-44))
Survival of x-irradiated beagles, 18: 25094 (UCD-472-109(p.173-7))
CALIFORNIA. UNIV., LIVERMORE. LAWRENCE RADIATION LAB.
Pulse multiplier using logarithmic diodes, 18: 25801 (NAS-NRC-Pub-1184(p.140-2))
CALIFORNIA. UNIV., LOS ANGELES.
Present status of Ξ decay, 18: 26275 (BNL-837(p.410-26))
CAMBRIDGE ELECTRON ACCELERATOR, MASS.
High-energy electron accelerators, 18: 26168 (CONF-401-2)
CARNEGIE INST. OF TECH., PITTSBURGH.
Muon capture in complex nuclei, 18: 26523 (BNL-837(p.292-7))
CENTRAL UTILITIES ATOMIC POWER ASSOCIATES.
Fabrication of collapse clad for Pathfinder, 18: 26914 (ACNP-63031)
CENTRE D'ÉTUDE DE L'ÉNERGIE NUCLÉAIRE, BRUSSELS.
Iodine-132, 18: 25039 (BLG-44)
CENTRO INFORMAZIONI STUDI ESPERIENZE, MILAN.
Autoclave with forced circulation, 18: 25639 (CISE-99)
CHICAGO. UNIV.
Argonne-Chicago neutrino experiment at ZGS, 18: 26166 (BNL-837 (p.170-89))

Wire chamber—computer system, 18: 25779 (CONF-182-15)
CHICAGO. UNIV. ENRICO FERMI INST. FOR NUCLEAR STUDIES.
Capture rate for muons in He-4, 18: 26524 (BNL-837(p.309-13))
COLUMBIA UNIV., NEW YORK.
Field theory of weak interactions, 18: 26267 (BNL-837(p.237-48))
Possible violation of $\Delta S = \Delta Q$, 18: 26262 (BNL-837(p.54-65))

D

DARTMOUTH COLL., HANOVER, N. H.
Prog. rpt. on two-phase flow, 1–3/64, 18: 25657 (NYO-3114-1)
DENMARK. ATOMENERGIKOMMISSIONEN. FORSØGSINSTITUT, RISØ.
Contamination in crystal monochromatization of neutrons, 18: 26499 (RISÖ-73))
Plane perpendicular NGD shocks, 18: 26693 (RISÖ-76)
DIGITAL EQUIPMENT CORP., MAYNARD, MASS.
Computer techniques, 18: 25881 (NAS-NRC-Pub-1184(p.266-8))
Time-shared computer for real-time information processing, 18: 25883 (NAS-NRC-Pub-1184(p.271-82))
DIVISION OF TECHNICAL INFORMATION EXTENSION, AEC.
Engineering materials list, 5/64, 18: 26987 (TID-4100(Suppl. 21))
DU PONT DE NEMOURS (E. I.) & CO. SAVANNAH RIVER LAB., AIKEN, S. C.
n-Paraffin mixtures as diluent for TBP in radiochemical separations, 18: 25605 (DP-882)
DUQUESNE LIGHT CO., SHIPPINGPORT, PENNA.
Prog. rpt. on Shippingport atomic power station, 3/64, 18: 26915 (DLCS-5000364)
Prog. rpt. on Shippingport atomic power station, 4/64, 18: 26916 (DLCS-5000464)

E

ELECTRO-OPTICAL SYSTEMS, INC., PASADENA, CALIF.
Gas flows through electric arcs: hot gas containment limits, 18: 26687 (ARL-64-49)
EUROPEAN ATOMIC ENERGY COMMUNITY.
Corrosion of C and stainless steels in water and steam. I., 18: 25922 (EURAEC-1038)
Prog. rpt. on Chooz nuclear power plant, annual, 1963, 18: 26920 (EUR-1804.f)
Prog. rpt. on Latina nuclear power plant, annual, 1963, 18: 26921 (EUR-1810.f)
Shutdown of D_2O reactor by sudden reactivity variation, 18: 26864 (EUR-548.f)
EUROPEAN ATOMIC ENERGY COMMUNITY. JOINT NUCLEAR RESEARCH CENTER, ISPRA, ITALY.
Shutdown of D_2O reactor by sudden reactivity variation, 18: 26864 (EUR-548.f)
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA.
CERN neutrino beam, 18: 26165 (BNL-837(p.91-113))
CERN neutrino experiment, 18: 26266 (BNL-837(p.160-9))
Design of 100-kG d-c magnet, 18: 26167 (CERN-64-23)
Fast pulse-height analyzer, 18: 25810 (NAS-NRC-Pub-1184(p.184-5))
Heavy liquid bubble chamber in CERN neutrino experiment, 18: 26265 (BNL-837(p.114-36))
Leptonic decays in unitary symmetry scheme, 18: 26272 (BNL-837 (p.299-302))
Muon capture in hydrogen, 18: 26271 (BNL-837(p.277-91))
Pulse analyzers in CERN, 18: 25783 (NAS-NRC-Pub-1184(p.18-22))
Radiative muon capture in Ca-40, 18: 26525 (BNL-837(p.315-23))

F

FANSTEEL METALLURGICAL CORP., NORTH CHICAGO, ILL.
Prog. rpt. on W sheet rolling, final, 6/60–3/63, 18: 25944 (N63-14854)
FRANCE. COMMISSARIAT A L'ENERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, SACLAY.
Electron probe microanalyzer: fluorescence excited by continuous radiation, 18: 26105 (CEA-R-2421)
Multiparameter analysis system for data collection and processing, 18: 25820 (NAS-NRC-Pub-1184(p.239-46))
Window problem in cylindrical geometry, 18: 26690 (D1-82-0217)

G

GENERAL ATOMIC DIV., GENERAL DYNAMICS CORP., SAN DIEGO, CALIF.
Catalysis of steam–graphite and CO disproportionation reactions by Ba, Sr, and Cs, 18: 25321 (GA-5215)
Fission-product-element yields and characteristics, 18: 25322 (GAMD-891(Rev.1))
Prog. rpt. on Cs-vapor cells, 5/60–10/63, 18: 26253 (GA-4677)
GENERAL DYNAMICS/ASTRONAUTICS, SAN DIEGO, CALIF.
Linear bending analysis of pressurized multicell shell structure, 18: 25633 (ERR-AN-336)
GENERAL DYNAMICS/FORT WORTH. DIV. OF GENERAL DYNAMICS CORP., FORT WORTH, TEX.
Magnetic shielding and superconductivity, 18: 26107 (ERR-FW-210)
GENERAL ELECTRIC CO. ATOMIC POWER EQUIPMENT DEPT., SAN JOSE, CALIF.
Fuel rods containing sintered UO_2 extrusions, 18: 25942 (GEAP-4556)
Prog. rpt. on in-core instrumentation development, 1–3/64, 18: 25780 (GEAP-4604)
Reactor pressure vessel material surveillance, 18: 26925 (GEAP-4423)
GENERAL ELECTRIC CO. HANFORD ATOMIC PRODUCTS OPERATION, RICHLAND, WASH.
Boiling burnout with fog-cooled 19-rod bundle, 18: 26900 (HW-80523 (Rev.1))
Drop test of unbuffered ¼-size model HAPO-IB cask, 18: 25708 (HW-77962)
Fission-product shipping cask, 18: 25707 (HW-65268(Rev.1))
Hydrogen content of fabricated U, 18: 25943 (HW-30116)
Plutonium Abstracts, Vol. 4, No. 4, 18: 26981 (HW-68600-38)
Preparation of U(IV) fluoride salts from uranyl sulfate, 18: 25323 (HW-48782)
Reactor engineering data system, 18: 26955 (HW-81088)
Spectrophotometric determination of B in Pu, 18: 25266 (HW-28529)
Thermal consequences of leaks in radioactive waste tanks, 18: 26976 (HW-80848)
Thermal flux in fuel element of reactor, 18: 26899 (HW-50086)
Transport of fluids in porous media. II., 18: 26975 (HW-72335(Pt.2))
GENEVA. UNIVERSITE.
Development of "nanoboxes", 18: 25827 (NAS-NRC-Pub-1184(p.325-30))
GEOLOGICAL SURVEY, WASHINGTON, D. C.
Adsorption equilibria between earth materials and radionuclides, Cape Thompson, Alaska, 18: 25688 (TID-20638)
Geologic map of Paiute Ridge Quadrangle, Nye and Lincoln Counties, Nevada, 18: 26984 (TEI-826)
Geologic map of Skull Mountain Quadrangle, NTS, 18: 26985 (TEI-845)
Geologic map of the Topopah Spring SW Quadrangle, Nevada, 18: 26986 (TEI-846)
Tritium as ground-water tracer, Eddy County, N. Mex. and tracer selection and tritium detection, 18: 25684 (TEI-839)
GEORGETOWN UNIV., WASHINGTON, D. C.
Production and identification of free radicals, 18: 25329 (TID-20645)
GERMANY. PHYSIKALISCHES STAATSINSTITUT, HAMBURG.
Pion production by linearly polarized photons, 18: 26276 (DESY-64/6)
GT. BRIT. CHEMICAL DEFENCE EXPERIMENTAL ESTABLISHMENT, PORTON, WILTS, ENGLAND.
Skin permeability and radioactive contamination, 18: 25056 (AHSB(RP)R-39(p.79-86))
GT. BRIT. MEDICAL RESEARCH COUNCIL, LONDON.
Assay of Sr-90 in human bone in UK, 18: 25735
GT. BRIT. MEDICAL RESEARCH COUNCIL. RADIOBIOLOGICAL RESEARCH UNIT, HARWELL, BERKS, ENGLAND.
Biological effects of radiation on skin, 18: 25081 (AHSB(RP)R-39 (p.21-9))
GT. BRIT. RADIOCHEMICAL CENTRE, AMERSHAM, BUCKS, ENGLAND.
Measurement of skin doses from skin contamination, 18: 25083 (AHSB(RP)R-39(p.44-68))

H

HARVARD UNIV., CAMBRIDGE, MASS.
Higher order leptonic weak interactions, 18: 26269 (BNL-837(p.257-65))
HELSINKI. UNIV.
Body burden of Cs-137 in people of Southern Finland 1961–1963, 18: 25687 (NP-13981)
Measurements of Cs-137 in Finnish Lapps in 1962–63, 18: 25710 (NP-13984)
Radioactive food chains in Arctic regions, 18: 25055 (NP-13985)
HONEYWELL RESEARCH CENTER, HOPKINS, MINN.
Ion and electron drift velocities in Cs, 18: 26103 (AROD-3588:2)
HUGHES AIRCRAFT CO., MALIBU, CALIF.
Scattering of light by light in plasmas, 18: 26692 (NP-14011)

I

ILLINOIS. UNIV., URBANA.
Solid state and nuclear results from Mössbauer studies with I-129, 18: 26111 (NP-13990)
INDIA. ATOMIC ENERGY ESTABLISHMENT, TROMBAY.
Analog-to-digital converter, 18: 25809 (NAS-NRC-Pub-1184(p.180-3))
Time-shared computer for real-time information processing, 18: 25883 (NAS-NRC-Pub-1184(p.271-82))
INSTITUT ZA NUKLEARNE NAUKE "BORIS KIDRIC," BELGRADE.
Spin fluctuation scattering of neutrons on pyrrhotite, 18: 26498 (PAN-280)
INSTITUTE FOR ADVANCED STUDY, PRINCETON, N. J.
Higher order leptonic weak interactions, 18: 26269 (BNL-837(p.257-65))
Theoretical considerations concerning neutrino experiments, 18: 26268 (BNL-837(p.249-56))
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA.
Conference on exponential and critical experiments, Amsterdam, 6/63. II., 18: 26881
Radioactive waste management, 18: 26979
Symposium on critical experiments, Amsterdam, 9/63. I., 18: 26873
IOWA. STATE UNIV., IOWA CITY.
Iowa four-parameter analyzer, 18: 25822 (NAS-NRC-Pub-1184(p.283-6))
Position-sensitive solid-state detector, 18: 25784 (NAS-NRC-Pub-1184 (p.42-5))
Starfish and Soviet artificial radiation belts, 18: 26188 (SUI-63-37)
ISRAEL INST. OF TECH., HAIFA.
Transistorized circuit modules for pulse-height analysis, 18: 25792 (NAS-NRC-Pub-1184(p.79-88))
ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, BOLOGNA.
Build up factors of J. J. Taylor equation, 18: 26814 (ORNL-tr-80)
ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, ROME.
Adsorption measurements by membrane electrodes, 18: 25327 (RT/GEO(64)-1)
Submarine hulls for nuclear-powered tanker, 18: 26959 (RTI/ING(63)-4)

J

JOINT INST. FOR NUCLEAR RESEARCH, DUBNA, U.S.S.R.
Pion beta decay, 18: 26273 (BNL-837(p.344-52))

K

KANSAS. UNIV., LAWRENCE.
Lanthanide boride systems and properties. I and II., 18: 25319 (COO-1140-103)
KERNKRAFTWERK RWE-BAYERWERK G.M.B.H., GUNDREMMINGEN, GERMANY.
Prog. rpt. on Gundremmingen nuclear power plant, annual, 1963, 18: 26918 (EUR-1802.d)

L

LINEAR, INC., WILMETTE, ILL.
Ultra high-speed analyzer-computer, 18: 25818 (NAS-NRC-Pub-1184 (p.229-36))
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Intermediate resonance structure in continuum shell model. I., 18: 26531 (LADC-6007)
One-dimensional dense gases with intermolecular potentials, 18: 26110 (LADC-6438)
Temperature measurement precision in Debye-Scherrer specimens, 18: 26109 (LA-2687)

M

MANLABS, INC., CAMBRIDGE, MASS.
High-pressure high-temperature metallurgy, 18: 25972 (ASD-TDR-63-90 (Vol.II))
MARYLAND. UNIV., COLLEGE PARK.
Lifetime of K_1^0 mesons, 18: 26261 (BNL-837(p.42-52))
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Refractory metal constitution diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
MECHANICAL TECHNOLOGY INC., LATHAM, N. Y.
Spiral-grooved, self-acting, gas bearing, 18: 25640 (TID-20632)
MICHIGAN. UNIV., ANN ARBOR.
Graphite-indicating electrodes, 18: 25320 (COO-1148-84)
MIDDLESEX HOSPITAL. COURTAULD INST. OF BIOCHEMISTRY, LONDON.
Biological effects of radiation on skin, 18: 25080 (AHSB(RP)R-39 (p.11-19))
MIDWEST RESEARCH INST., KANSAS CITY, MO.
Physical basis of mechanical properties of ceramics, 18: 25973 (ASD-TDR-63-605(Pt.II))
MILAN. POLITECNICO.
Current pulses released by Si surface-barrier detectors, 18: 25786 (NAS-NRC-Pub-1184(p.49-52))
Timing with semiconductor detectors, 18: 25787 (NAS-NRC-Pub-1184 (p.53-8))
MILAN. UNIVERSITÀ.
Energetics transfer in photodynamic reaction, 18: 26983 (NYO-2734-1)
Flexibility of standard pulse-height analyzer for multiparameter experiments, 18: 25819 (NAS-NRC-Pub-1184(p.237-8))
MONSANTO RESEARCH CORP. DAYTON LABS., OHIO.
Prog. rpt. on high-temperature thermoelectric research, 12/31/63–4/3/64, 18: 26251 (AD-437280)
MOUND LAB., MIAMISBURG, OHIO.
Comparative properties of He-3 and He-4, 18: 25325 (MLM-1161)
Heating vacuum-tube cathodes with Po-210, 18: 25870 (MLM-1154)

N

NAGOYA, JAPAN. UNIV.
Microwave radiation at cyclotron harmonics in positive column, 18: 26691 (IPPJ-23)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GEORGE C. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.
Compact lunar power station, 18: 26956 (MTP-ASTR-A-63-8)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
Excitation of H atom induced by electron impact, 18: 26203 (NASA-TN-D-2145)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND.
Visible radiation damage effects of 40-Mev α particles on NaCl crystals, 18: 26071 (NASA-TN-D-2329)
NATIONAL CARBON CO., PARMA, OHIO.
Thermal stresses in anisotropic hollow cylinders, 18: 26116 (WADD-TR-61-72(Vol.XIX))
NATIONAL LEAD CO. OF OHIO, CINCINNATI.
Fabrication of U and U-base alloy tubes and rods, 18: 25940 (BMI-X-[illegible])
Prog. rpt., 1–3/64, 18: 25269 (NLCO-905)
NATIONAL RESEARCH COUNCIL. COMMITTEE ON NUCLEAR SCIENCE.
Adiabatic light pipe for improved light collection and timing, 18: 25785 (NAS-NRC-Pub-1184(p.46-7))
Analog pulse arithmetic by use of logarithmic p-n junctions, 18: 25800 (NAS-NRC-Pub-1184(p.136-9))
Analog-to-digital converter, 18: 25809 (NAS-NRC-Pub-1184(p.180-3))

Analyzer systems at ORNL, 18: 25745 (NAS-NRC-Pub-1184(p.40-1))
Causes of inaccuracy in analog-to-digital conversion, 18: 25811 (NAS-NRC-Pub-1184(p.186-94))
Conference on instrumentation in nuclear pulse analysis, U. S. Naval Postgraduate School, Monterey, Calif., 4/20–5/3/63, 18: 25781 (NAS-NRC-Pub-1184)
Current pulses released by Si surface-barrier detectors, 18: 25786 (NAS-NRC-Pub-1184(p.49-52))
Development of "nanoboxes", 18: 25827 (NAS-NRC-Pub-1184(p.325-30))
Digital stabilizing methods for multichannel analyzing systems, 18: 25804 (NAS-NRC-Pub-1184(p.150-64))
Direct 3-D display, 18: 25748 (NAS-NRC-Pub-1184(p.320-1))
Display system for multiparameter experiments, 18: 25826 (NAS-NRC-Pub-1184(p.322-3))
Event timing, 18: 25796 (NAS-NRC-Pub-1184(p.117-18))
Fast pulse-height analyzer, 18: 25810 (NAS-NRC-Pub-1184(p.184-5))
Fast transistorized amplifier with large dynamic range, 18: 25793 (NAS-NRC-Pub-1184(p.89-95))
Field-effect transistors in charge-sensitive amplifiers, 18: 25791 (NAS-NRC-Pub-1184(p.70-8))
Field effect transistors in low-noise wideband voltage and charge-sensitive preamplifiers, 18: 25812 (NAS-NRC-Pub-1184(p.204-6))
Flexibility of standard pulse-height analyzer for multiparameter experiments, 18: 25819 (NAS-NRC-Pub-1184(p.237-8))
Identification of charged particles with solid-state detector, 18: 25794 (NAS-NRC-Pub-1184(p.96-103))
Improving low-level linearity of pulse-height-to-time converters, 18: 25806 (NAS-NRC-Pub-1184(p.169-71))
Information processing equipment for physics at Chalk River, 18: 25742 (NAS-NRC-Pub-1184(p.23-35))
Information processing systems at Brookhaven, 18: 25743 (NAS-NRC-Pub-1184(p.36-7))
Information processing systems at Argonne, 18: 25744 (NAS-NRC-Pub-1184(p.38-9))
Iowa four-parameter analyzer, 18: 25822 (NAS-NRC-Pub-1184(p.283-6))
Light flash generator for gain stabilization of photosensitive systems, 18: 25817 (NAS-NRC-Pub-1184(p.220-8))
Light probe digital interrogator for analyzer oscilloscope displays, 18: 25825 (NAS-NRC-Pub-1184(p.313-19))
Linear amplifier, gating and timing system, 18: 25799 (NAS-NRC-Pub-1184(p.124-34))
Linear gate and biased amplifier, 18: 25797 (NAS-NRC-Pub-1184(p.119-20))
Low-noise pre-amplifier for use with semiconductor detectors, 18: 25789 (NAS-NRC-Pub-1184(p.61-4))
Low-noise pulse amplifiers, 18: 25790 (NAS-NRC-Pub-1184(p.65-9))
Magnetic tape systems at Harwell, 18: 25747 (NAS-NRC-Pub-1184(p.296-304))
Multichannel transistorized pulse-height analyzer, 18: 25805 (NAS-NRC-Pub-1184(p.165-8))
Multidimensional kicksorter using magnetic-tape storage, 18: 25824 (NAS-NRC-Pub-1184(p.305-12))
Multiparameter analysis system for data collection and processing, 18: 25820 (NAS-NRC-Pub-1184(p.239-46))
Multiparameter pulse-height recording system, 18: 25823 (NAS-NRC-Pub-1184(p.287-91))
Neutron time-of-flight zero cross-over pulse shape discriminator, 18: 25803 (NAS-NRC-Pub-1184(p.146-9))
Nuclear radiation recorder analyzer, 18: 25821 (NAS-NRC-Pub-1184(p.255-65))
Performance of analog-to-digital converter, 18: 25808 (NAS-NRC-Pub-1184(p.177-9))
Phototube noise rejection using pulse cross-over technique, 18: 25802 (NAS-NRC-Pub-1184(p.143-5))
Position-sensitive solid-state detector, 18: 25784 (NAS-NRC-Pub-1184(p.42-5))
Pulse analysis at Harwell, 18: 25782 (NAS-NRC-Pub-1184(p.15-17))
Pulse analyzers in CERN, 18: 25783 (NAS-NRC-Pub-1184(p.18-22))
Pulse multiplier using logarithmic diodes, 18: 25801 (NAS-NRC-Pub-1184(p.140-2))
"Ramp-pulser" for testing linearity of pulse-analysis systems, 18: 25816 (NAS-NRC-Pub-1184(p.216-19))
Standardization [of instruments], 18: 25814 (NAS-NRC-Pub-1184(p.210-11))
Timing using semiconductor detectors, 18: 25788 (NAS-NRC-Pub-1184(p.59-60))
Timing with semiconductor detectors, 18: 25787 (NAS-NRC-Pub-1184(p.53-8))
Use of Atlas on-line, 18: 25880 (NAS-NRC-Pub-1184(p.247-54))
Use of avalanche diodes to produce random pulses, 18: 25815 (NAS-NRC-Pub-1184(p.212-15))
Use of pulse analyzers for measurement of transfer functions by cross-correlation, 18: 25813 (NAS-NRC-Pub-1184(p.207-9))
Use of storage tubes as temporary stores for pulse amplitudes, 18: 25746 (NAS-NRC-Pub-1184(p.292-5))

NAVAL AIR ENGINEERING CENTER, PHILADELPHIA.
Size effect in fine Be wire, 18: 25975 (NAEC-AML-1909)

NAVAL RADIOLOGICAL DEFENSE LAB., SAN FRANCISCO.
Compartmentalization effects on dose rate in radiation field of reactor, 18: 25712 (USNRDL-TR-722)

NAVAL RESEARCH LAB., WASHINGTON, D. C.
Characteristics of air filter media used for monitoring airborne radioactivity, 18: 26098 (NRL-6054)

NEW MEXICO. UNIV., ALBUQUERQUE.
One-dimensional dense gases with intermolecular potentials, 18: 26110 (LADC-6438)

NEW YORK OPERATIONS OFFICE, AEC.
Non-destructive measurement of U-235 in absolute air filters, 18: 25270 (NYO-10726)

NEW YORK OPERATIONS OFFICE. HEALTH AND SAFETY LAB., AEC.
Determination of Ce-144 in vegetation and soil, 18: 25265 (HASL-143)

NEW YORK. STATE UNIV., BUFFALO.
Prog. rpt. on tissue cell growth, final, 8/15/62–1/31/64, 18: 26982 (NYO-2462-1)
Serum erythropoietic factor in anemia of malignancy, 18: 26988 (TID-20635)

NEW YORK UNIV., NEW YORK.
Astrophysics and fundamental neutrino interactions, 18: 26187 (BNL-837(p.193-233))

NORTHERN STATES POWER CO., MINNEAPOLIS.
Fabrication of collapse clad for Pathfinder, 18: 26914 (ACNP-63031)

NORTHWESTERN UNIV., EVANSTON, ILL.
Capture rate for muons in He-4, 18: 26524 (BNL-837(p.309-13))
Lifetime of $_{\Lambda}H^{4}$, 18: 26527 (BNL-837(p.454-6))

NUCLEAR MATERIALS AND EQUIPMENT CORP., APOLLO, PENNA.
Prog. rpt. on Pu fuels, 1/64, 18: 26901 (NUMEC-2389-2)
Prog. rpt. on Pu fuel materials, 2/64, 18: 25895 (NUMEC-2389-3)

NUCLEAR METALS. DIV. OF TEXTRON INC., WEST CONCORD, MASS.
Prog. rpt. on metallurgy, 4/64, 18: 25894 (NMI-2128)
Refractory metal constitution diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Tungsten alloys containing Re, 18: 25976 (NMI-1261)

NUCLEAR-POWERED SHIP RESEARCH ASSN. OF JAPAN, TOKYO.
Secondary shielding for marine nuclear reactor, 18: 26958 (NP-12562)

O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
Determination of Sr-90 in drinking water, 18: 25267 (K-1521)
Uranium density of systems, 18: 25324 (K-1609)

OAK RIDGE NATIONAL LAB., TENN.
Alignment of rare earth moments in dilute Pd–Fe alloys, 18: 25977 (ORNL-3582(p.2-4))
Alpha-alpha correlations in $Li^{7} + d \rightarrow 2\alpha + n$, 18: 26548 (ORNL-3582(p.99))
Analyzer systems at ORNL, 18: 25745 (NAS-NRC-Pub-1184(p.40-1))
Antiferromagnetism of ordered Pd_2Cr, 18: 25978 (ORNL-3582(p.5-6))
Computer program for spin-½ particles, 18: 26556 (ORNL-TM-875)
Conversion electrons from nuclear states of In excited by (p,n) reactions, 18: 26553 (ORNL-3582(p.115-17))
Conversion of radioactive liquid wastes to solids, 18: 26978 (ORNL-TM-857)
Correlation of Mössbauer isomer shift with residual electrical resistance for Au alloys, 18: 26534 (ORNL-3582(p.16-17))
Coulomb excitation of vibrational triplet states and octupole states in

even Cd nuclei, 18: 26551 (ORNL-3582(p.107-11))
Coulomb excitation of Br-81 with α particles, 18: 26552 (ORNL-3582 (p.112-14))
Dissolution of ThO–UO_2 fuel particles in HNO_3–HF solutions, 18: 25608 (ORNL-TM-867)
Elastic scattering of 17- to 21-Mev neutrons from C-12, 18: 26547 (ORNL-3582(p.93-4))
Electron microscope for determination of molecular structure, 18: 25749 (ORNL-3582(p.40-1))
Field effect transistors in low-noise wideband voltage and change-sensitive preamplifiers, 18: 25812 (NAS-NRC-Pub-1184(p.204-6))
Fission of oriented nuclei, 18: 26554 (ORNL-3582(p.121-6))
Gamma spectra from neutron capture in isotopes of Sn, 18: 26540 (ORNL-3582(p.62-7))
Gamma spectra from resonant neutron capture on F-19, 18: 26541 (ORNL-3582(p.68-71))
Head-end treatments of Purex-1WW waste for fission-product recovery, 18: 25606 (ORNL-3585)
Helium-3-induced charged-particle reactions, 18: 26549 (ORNL-3582 (p.100-1))
High Flux Isotope Reactor, I., 18: 26962 (ORNL-3572)
High-resolution neutron total cross sections, 18: 26543 (ORNL-3582 (p.75-82))
Hyperfine splitting in alloys of Fe–Rh, 18: 25982 (ORNL-3582 (p.18-19))
Interaction of neutrons with Pb-208, 18: 26545 (ORNL-3582(p.86-90))
Magnetic properties of intra-rare-earth alloys, 18: 25980 (ORNL-3582(p.9-10))
Magnetic structure properties of rare-earth alloys, 18: 25981 (ORNL-3582(p.11-16))
Neutron-diffraction investigation of Cr alloys, 18: 25979 (ORNL-3582 (p.7-8))
Neutron time-of-flight zero cross-over pulse shape discriminator, 18: 25803 (NAS-NRC-Pub-1184(p.146-9))
Nuclear radii of isotopes of Sn, 18: 26538 (ORNL-3582(p.56-7))
Optical Physics, 18: 26114 (ORNL-3582(p.36-7))
ORNL master analytical manual indexes, 18: 25271 (TID-7015(Indexes) (Rev.1))
Parameters of low-energy resonances in W, 18: 26539 (ORNL-3582 (p.58-60))
Parity in Σ^- interaction with He, 18: 26278 (ORNL-3582(p.129))
Polarization of totally reflected Mössbauer radiation, 18: 26535 (ORNL-3582(p.20-3))
Possibilities and consequences of major accidents in fuel fabrication and radioisotope processing plants, 18: 25711 (ORNL-3441)
Production of Ca-47, 18: 25876 (ORNL-IIC-2)
Prog. rpt. on physics, annual, 1/64, 18: 26113 (ORNL-3582)
Properties of lanthanide germano-molybdates, 18: 25317 (CONF-405-31)
Quantized space-time, 18: 26387 (ORNL-3582(p.41-5))
Radioisotopes procedures manual, 18: 25607 (ORNL-3633)
Reactions $Mg(\alpha,\alpha)Mg^{24}$ and $Mg^{24}(\alpha,\alpha')Mg^{24*}$, 18: 26550 (ORNL-3582 (p.101-2))
Resonant neutron capture γ spectra from nuclei in s-d shell, 18: 26542 (ORNL-3582(p.71-5))
Scattering of protons by Ho-165, 18: 26537 (ORNL-3582(p.55))
Scattering of 17.5-Mev protons by Ni-62, 18: 26536 (ORNL-3582(p.54))
Scattering of 3- to 4-Mev neutrons from O-16, 18: 26546 (ORNL-3582 (p.90-2))
Search for Λ-nucleon resonance, 18: 26277 (ORNL-3582(p.127-8))
Strength function of isotopes of Zr, 18: 26544 (ORNL-3582(p.82-4))
Target preparation program, 18: 25877 (ORNL-3400)
Wave functions for muon capture in H μ-molecular ion, 18: 26555 (ORNL-3582(p.130))

OSTERREICHISCHE STUDIENGESELLSCHAFT FUR ATOMENERGIE G.M.B.H., SEIBERSDORF, AUSTRIA.
Analysis of nuclear fuel. I., 18: 25610 (SGAE-CH-4/1964)
Dental fluoroscopy with aid of radiation source, 18: 25234 (SGAE-IB/1A-2/1964)
Early damage in cells after ionizing radiation. II., 18: 25085 (SGAE-BL-5/1964)
Pneumatic mixing silo for cement with radioactive substances, 18: 25871 (SGAE-IB/1A-1/1964)

Xenon and Ba diffusion on uncoated and coated ceramic fuel particles, 18: 25983 (SGAE-ME-1/1964)

P

PARIS. ECOLE POLYTECHNIQUE.
Leptonic decay of hyperons, 18: 26274 (BNL-837(p.355-77))

PARIS. UNIVERSITÉ, ORSAY.
Statistical plasma theory. II., 18: 26686 (ARL-64-44(Pt.II))

PFAUDLER CO., ROCHESTER, N. Y.
Prog. rpt. on coatings for Nb alloys, 12/62–2/63, 18: 25896 (PF-63-3)

PHILADELPHIA GENERAL HOSPITAL.
Radiation effects on DNA of spleen, 18: 25084 (NYO-2568-1)

PHILLIPS PETROLEUM CO., IDAHO FALLS, IDAHO.
Light probe digital interrogator for analyzer oscilloscope displays, 18: 25825 (NAS-NRC-Pub-1184(p.313-19))

PHILLIPS PETROLEUM CO. ATOMIC ENERGY DIV., IDAHO FALLS, IDAHO.
Waste calcining facility safety analysis, 18: 26977 (IDO-14620)

POLISH ACADEMY OF SCIENCES. INST. OF NUCLEAR PHYSICS, KRAKOW.
Spin fluctuation scattering of neutrons on pyrrhotite, 18: 26498 (PAN-28)

POLISH ACADEMY OF SCIENCES. INST. OF NUCLEAR RESEARCH. WARSAW.
Mechanism of tripartition, 18: 26557 (PAN-481/I)
Thermostat with 0.0005° regulation accuracy, 18: 25750 (PAN-459/XVI)

PRATT AND WHITNEY AIRCRAFT DIV., UNITED AIRCRAFT CORP. CONNECTICUT AIRCRAFT NUCLEAR ENGINE LAB., MIDDLETOWN.
Instrumentation for determining Ar and He purity, 18: 25264 (CNLM-4016)

PRINCETON UNIV., N. J.
Adiabatic light pipe for improved light collection and timing, 18: 25785 (NAS-NRC-Pub-1184(p.46-7))
K_1–K_2 mass difference, 18: 26263 (BNL-837(p.74-81))

PURDUE UNIV., LAFAYETTE, IND.
Rare earth oxyfluorides. 18: 25318 (CONF-405-39)

R

RADIATION INSTRUMENT DEVELOPMENT LAB., INC., OAK RIDGE, TENN.
Time discrimination in pulse-height analysis, 18: 25795 (NAS-NRC-Pub-1184(p.112-16))

RESEARCH AND TECHNOLOGY DIV. AIR FORCE MATERIALS LAB., WRIGHT-PATTERSON AFB, OHIO.
Determination of Ti and Zr in Mo, 18: 25268 (ML-TDR-64-36)

RICE UNIV., HOUSTON, TEX.
Standardization [of instruments], 18: 25814 (NAS-NRC-Pub-1184(p.210-11))

ROCHESTER, N. Y. UNIV. ATOMIC ENERGY PROJECT.
Behavioral effects in pigeons exposed to Hg vapor, 18: 25057 (UR-645)

ROSWELL PARK MEMORIAL INST., BUFFALO.
Serum erythropoietic factor in anemia of malignancy, 18: 26988 (TID-20635)

RUTGERS UNIV., NEW BRUNSWICK, N. J.
Effect of suspended solids on Lagrangian properties of fluid turbulence, 18: 25656 (NYO-2930-2)
Possible violation of $\Delta S = \Delta Q$, 18: 26262 (BNL-837(p.54-65))
Prog. rpt. on solid state theory, 4/64, 18: 26459 (AD-437194)

S

SANDIA CORP., ALBUQUERQUE, N. MEX.
Prog. rpt. on Be study, 1–3/64, 18: 25328 (SC-DC-64-864)

SANDIA CORP. LIVERMORE LAB., LIVERMORE, CALIF.
Stress analysis of filament-wound shell structures, 18: 26115 (SCL-TM-64-53)

SCHWEISSTECHNISCHE LEHR- UND VERSUCHSANSTALT, DUISBURG, GERMANY.
Prog. rpt. on welding of reactor steels, 1–3/64, 18: 25945 (EURAEC-1039)

SCIENTIFIC DATA SYSTEMS, SANTA MONICA, CALIF.

SDS 9300-preliminary specification, 18: 25882 (NAS-NRC-Pub-1184 (p.269-70))
SOCIETÁ ELETTRONUCLEARE NAZIONALE, ROME.
Prog. rpt. on Garigliano nuclear power plant, annual, 1963, 18: 26919 (EUR-1803.i)
SOCIETA ITALIANA MERIDIONALE ENERGIA ATOMICA, LATINA.
Failure and successive recovery of control rods, 18: 26923 (EUR-1810.i(Paper 6))
First "fast burst" occurring in Latina Reactor, 18: 26922 (EUR-1810.i(Paper 5))
Prog. rpt. on Latina nuclear power plant, annual, 1963, 18: 26921 (EUR-1810.i)
SOCIETE D'ENERGIE NUCLEAIRE FRANCO-BELGE DES ARDENNES, CHOOZ-LEZ-GIVET, FRANCE.
Prog. rpt. on Chooz nuclear power plant, annual, 1963, 18: 26920 (EUR-1804.f)
SOCIETE D'ETUDES, DE RECHERCHES ET D'APPLICATIONS POUR L'INDUSTRIE, BRUSSELS.
Corrosion of C and stainless steels in water and steam. I., 18: 25922 (EURAEC-1038)
SOUTH DEVON AND EAST CORNWALL HOSPITAL, PLYMOUTH, ENGLAND.
Treatment of over-irradiated skin, 18: 25214 (AHSB(RP)R-39(p.87-93))
SOUTHWEST RESEARCH INST., SAN ANTONIO.
Fatigue strength of pressure vessels, 18: 25680 (TID-20648)
STANFORD RESEARCH INST., MENLO PARK, CALIF.
Radiation-induced reactions in swollen polymers, 18: 25469 (SRIA-120)
SYRACUSE UNIV., N. Y.
Lifetime of $_{\Lambda}H^{3}$, 18: 26527 (BNL-837(p.454-6))
Sodium–Sr equilibrium system, 18: 25984 (TID-20639)

T

TELEFUNKEN G.M.B.H., ULM, GERMANY.
Fast binary analog-to-digital converter, 18: 25807 (NAS-NRC-Pub-1184 (p.172-6))
THOMPSON RAMO WOOLDRIDGE INC. TRW SPACE TECHNOLOGY LABS., REDONDO BEACH, CALIF.
Prog. rpt. on Be study, 1–3/64, 18: 25328 (SC-DC-64-864)
TOKYO UNIV.
Line-broadening due to ionized impurity scattering in Ge, 18: 26112 (NP-14017)
TORONTO. UNIV.
Mechanics of rarefied gases and plasmas, 18: 26688 (ARL-64-60)
TRACERLAB. DIV. OF LAB. FOR ELECTRONICS, INC., RICHMOND, CALIF.
Scintillating anion exchange resin, 18: 25259 (NYO-10405)

U

U.S.S.R. SOVET MINISTROV. GOSUDARSTVENNYI KOMITET PO ISPOL'ZOVANIYU ATOMNOĬ ENERGII.
Systems in external field, 18: 26386 (NP-13958)
UNION CARBIDE CORP. NUCLEAR DIV. Y-12 PLANT, OAK RIDGE, TENN.
X-ray fluorescence tables: LiF crystal, 18: 25330 (Y-1470-C)
X-ray fluorescence tables: EDDT crystal, 18: 25449 (Y-1470-D)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. AUTHORITY HEALTH AND SAFETY BRANCH. RADIOLOGICAL PROTECTION DIV., HARWELL, BERKS, ENGLAND.
Anatomy and physiology of skin, 18: 25038 (AHSB(RP)R-39(p.1-10))
Biological effects of radiation on skin, 18: 25080 (AHSB(RP)R-39 (p.11-19))
Biological effects of radiation on skin, 18: 25081 (AHSB(RP)R-39 (p.21-9))
Conference on radiation and skin, AERE, Winfrith, 11/63, 18: 25037 (AHSB(RP)R-39)
Decontamination of skin, 18: 25213 (AHSB(RP)R-39(p.69-77))
Measurement of skin doses from external radiation, 18: 25082 (AHSB(RP)R-39(p.31-43))
Measurement of skin doses from skin contamination, 18: 25083 (AHSB(RP)R-39(p.44-68))
Skin permeability and radioactive contamination, 18: 25056 (AHSB(RP)R-39(p.79-86))
Treatment of over-irradiated skin, 18: 25214 (AHSB(RP)R-39(p.87-93))
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. INDUSTRIAL GROUP. WINDSCALE WORKS, SELLAFIELD, CUMB., ENGLAND.
Decontamination of skin, 18: 25213 (AHSB(RP)R-39(p.69-77))
Decontamination of skin, 18: 25213 (AHSB(RP)R-39(p.69-77))
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP. ATOMIC ENERGY ESTABLISHMENT, WINFRITH, DORSET, ENGLAND.
Anatomy and physiology of skin, 18: 25038 (AHSB(RP)R-39(p.1-10))
Characteristics of mineral insulated cables for reactor control pulse counting channels, 18: 26830 (AEEW-M-369)
Measurement of skin doses from external radiation, 18: 25082 (AHSB(RP)R-39(p.31-43))
Metals for construction of wide-range ionization chamber, 18: 25776 (AEEW-M-381)
Saturation characteristics of He in d-c fission chamber, 18: 25777 (AEEW-M-395)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL, BERKS, ENGLAND.
Analog pulse arithmetic by use of logarithmic p-n junctions, 18: 25800 (NAS-NRC-Pub-1184(p.136-9))
Display system for multiparameter experiments, 18: 25826 (NAS-NRC-Pub-1184(p.322-3))
Event timing, 18: 25796 (NAS-NRC-Pub-1184(p.117-18))
Improving low-level linearity of pulse-height-to-time converters, 18: 25806 (NAS-NRC-Pub-1184(p.169-71))
Low-noise pulse amplifiers, 18: 25790 (NAS-NRC-Pub-1184(p.65-9))
Magnetic tape systems at Harwell, 18: 25747 (NAS-NRC-Pub-1184(p.296-304))
Mass spectrometer and isotope separator facilities at AERE, 18: 25740 (EANDC(UK)-25L)
Performance of analog-to-digital converter, 18: 25808 (NAS-NRC-Pub-1184(p.177-9))
Pulse analysis at Harwell, 18: 25782 (NAS-NRC-Pub-1184(p.15-17))
Separation of nitrato- and nitro-complexes of nitrosylruthenium, 18: 25602 (AERE-R-4583)
Use of Atlas on-line, 18: 25880 (NAS-NRC-Pub-1184(p.247-54))
Use of avalanche diodes to produce random pulses, 18: 25815 (NAS-NRC-Pub-1184(p.212-15))
Use of pulse analyzers for measurement of transfer functions by cross-correlation, 18: 25813 (NAS-NRC-Pub-1184(p.207-9))
Use of storage tubes as temporary stores for pulse amplitudes, 18: 25746 (NAS-NRC-Pub-1184(p.292-5))
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. RADIOCHEMICAL CENTRE, AMERSHAM, BUCKS, ENGLAND.
Apparatus for micro-scale liquid-liquid extractions, 18: 25609 (RCC-M-173)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. WANTAGE RESEARCH LAB., WANTAGE, BERKS, ENGLAND.
Free radical addition reactions initiated by high-energy radiation, 18: 25466 (AERE-R-4587)
Radiolytic oxidation of methane. I., 18: 25465 (AERE-R-4581)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. WEAPONS GROUP. ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON, BERKS, ENGLAND.
Bibliography on analysis of U, 18: 25263 (AWRE/Lib/Bib/8)
Data listing program for U.K.A.E.A. Nuclear Data Library, 18: 25879 (AWRE-O-4/64)
Permeability of neoprene and polyvinylchloride to H, D, and T, 18: 25706 (AWRE-O-17/62)
Permeability of synthetic rubbers to H, 18: 25467 (AWRE-O-54/57)
Permeation of gases through latex and neoprene, 18: 25315 (AWRE-O-56/57)
Solution of two-dimensional axially symmetric multigroup stationary neutron transport equation, 18: 26497 (AWRE-O-66/63)
Uranium compatibility studies. II., 18: 25921 (AWRE-O-25/64)
UNITED STATES–EURATOM JOINT RESEARCH AND DEVELOPMENT PROGRAM.
Corrosion of C and stainless steels in water and steam. I., 18: 25922 (EURAEC-1038)

Metals subjected to stress and irradiation, 18: 25974 (EURAEC-1037)
Prog. rpt. on improvement of BWR stability, 1–4/64, 18: 26924 (EURAEC-1065)
Prog. rpt. on two-phase flow, 1–3/64, 18: 25657 (NYO-3114-1)
Prog. rpt. on welding of reactor steels, 1–3/64, 18: 25945 (EURAEC-1039)
Reactor pressure vessel material surveillance, 18: 26925 (GEAP-4423)

W

WAKE FOREST COLL., WINSTON-SALEM, N. C.
Prog. rpt. on aging effect of radiation, final, 12/60–4/64, 18: 25087 (TID-20541)
WASHINGTON. UNIV., SEATTLE. COLL. OF ENGINEERING.
Conserved vector current theory in forbidden β transitions, 18: 26526 (BNL-837(p.340-3))
WESTINGHOUSE ELECTRIC CORP. ATOMIC POWER DIV., PITTSBURGH.
Cost analysis of SCOTT-R, 18: 26928 (WCAP-2294)
Power distributions and control worths in two-region clustered UO_2–D_2O lattice, 18: 26863 (CVNA-134)
WESTINGHOUSE ELECTRIC CORP. BETTIS ATOMIC POWER LAB., PITTSBURGH.
Thermal conductivity of oxide fuel elements, 18: 26073 (WAPD-246)
WESTINGHOUSE ELECTRIC CORP. ELECTRONIC TUBE DIV., ELMIRA, N. Y.
Planar dynode multipliers for high-speed counting, 18: 25739 (CONF-182-16)
WESTINGHOUSE ELECTRIC CORP. RESEARCH LABS., PITTSBURGH
Planar dynode multipliers for high-speed counting, 18: 25739 (CONF-182-16)
Refractory metal constitution diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
WORCESTER FOUNDATION FOR EXPERIMENTAL BIOLOGY, SHREWSBURY, MASS.
Prog. rpt. on biologically active amines, annual, 8/63–5/64, 18: 25[illegible] (TID-20536)

Y

YESHIVA UNIV., NEW YORK.
Models for interactions, 18: 26270 (BNL-837(p.266-74))

PERSONAL AUTHOR INDEX

Each entry after an author's name is a shortened version of the title of the report or article, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt.," permitting a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

Because of problems involving the mechanical preparation of this index, all accent marks are omitted. The following changes in spelling have been introduced to reduce some of the confusion which might result from omitting the accents:

ä becomes	ae
ö	oe
ø	oe
ü	ue (except in transliterated Chinese names)

A

AARONSON, H. I., Self-diffusion of Ag in beta AgMg, 18: 26051

ABDEL-RASSOUL, A. A., Separation of carrier-free Sc isotopes, 18: 25298

ABDULLAEV, M. D., Effect of general x radiation on transplanted tumors, 18: 25197

ABDULLAEV, V. M., Ascorbic acid content in brain tissue of dogs with radiation sickness, 18: 25161

ABE, Hitoshi, Beta-induced crosslinking of polyvinyl alcohol, 18: 25488 (AEC-tr-6372(p.185-92))

ABE, Hitoshi, Beta irradiation of acetylated polyvinyl alcohol, 18: 25489 (AEC-tr-6372(p.193-5))

ABE, Hitoshi, Radiation-induced graft polymerization on polyvinyl alcohol, 18: 25485 (AEC-tr-6372(p.159-61))

ACKROYD, Ronald Tunstall, Improvements in fast nuclear reactors, 18: 26889

ACQUISTA, N., Electronic band spectrum of Y monofluoride, 18: 26163

ADAM, J., Materials for nuclear thermionic converters, 18: 26259

ADAMS, D. E., Transient forced convection from flat plate, 18: 25666

ADAMS, G. E., Hydrogen formation in radiolysis of liquid ethanol, 18: 25589

ADAR, Simcon A., Separation of actinides from each other, 18: 25631

ADLER, Peter, Analysis of gases and vapors using radiation, 18: 25290

AGASYAN, E. O., Fluctuation and ionization in low-pressure detectors, 18: 25831

AHARONOV, Y., Time-energy indeterminacy relation, 18: 26418

AHARONOV, Yakir, Time symmetry in quantum process of measurement, 18: 26417

AHLERS, Guenter, *Ortho-para* conversion in solid H, 18: 25370

AHLERS, Guenter, Properties of He-4 near γ phase, 18: 26485

AHLSTROM, H. G., Shock waves in electrically driven shock tube, 18: 25645

AIKIN, A. M., Extraction of Pu with triethylene glycol dichloride, 18: 25603 (CEI-18)

AKASAKA, Kazuyuki, ESR of irradiated L-cystine dihydrochloride, 18: 25565

AKERMAN, Bengt, Observations on pigeons with prethalamic radiolesions, 18: 25099

AKHMEDOV, S. Sh., Production of high magnetic fields, 18: 26474

AKIMOTO, Yuzi, Preparation of anhydrous UF_4, 18: 25448

ALBERIGI-QUARANTA, A., Fast transistorized amplifier with large dynamic range, 18: 25793 (NAS-NRC-Pub-1184(p.89-95))

ALBERIGI-QUARANTA, A., Multichannel transistorized pulse-height analyzer, 18: 25805 (NAS-NRC-Pub-1184(p.165-8))

ALEKSANDROV, O. M., High-temperature oxidation of Mo silicides, 18: 25928

ALEXANDER, T. K., Identification of charged particles with solid-state detector, 18: 25794 (NAS-NRC-Pub-1184(p.96-103))

ALEXANDER, T. K., Multidimensional kicksorter using magnetic-tape storage, 18: 25824 (NAS-NRC-Pub-1184(p.305-12))

ALFIMOV, N. N., Total β activity of water and air areas of Pacific Ocean, 18: 25690

ALIEV, M. K., Equations for π-N scattering at low energies, 18: 26299

ALIKHANOV, S. G., Weakly ionized He plasma in magnetic field, 18: 26768

ALINE, P. G., General Electric core design philosophy, 18: 26826

ALIPRANDI, Bianca, Neutron irradiation of solid acetylhydrazide, 18: 25556

ALIPRANDI, G., Changes of DNA of guinea pigs subjected to x irradiation, 18: 25102

ALLCOCK, G. McK., Current-jet hypothesis of whistler generation, 18: 26450

ALLEN, A. O., Determination of ion pairs in irradiation of liquid, 18: 25555

ALLEN, R. J., Long superconductive delay lines, 18: 26490

ALLINA, Zygmunt, Determination of Cu, Zn, and As in acids, 18: 25286

ALS-NIELSEN, J., Contamination in crystal monochromatization of neutrons, 18: 26499 (RISO-73)

ALSTON, Margaret H., Search for Yf resonances, 18: 26328

ALTMANN, H., Early damage in cells after ionizing radiation. II., 18: 25085 (SGAE-BL-5/1964)

ALVAEGER, T., Upper limits for anomalous interactions of muon neutrinos, 18: 26321

AMAMIYA, Ayao, Irradiation-graft polymerization of styrene of rayon, 18: 25534 (AEC-tr-6372(p.593-602))

AMANO, Fumio, Efficiency of multiple control rods. II., 18: 26833

AMATO, I., Activation energy of sintering non-stoichiometric UO_{2+x}, 18: 26030

AMATUNI, A. Ts., Radiation of variable moving with constant velocity, 18: 26296

AMAVIS, Rene, Improvements in or relating to ion exchangers, 18: 25262

AMEEN, D. L., Fast-acting superconducting power switches, 18: 26493

AMES, Lloyd L., Jr., Removing Ru from aqueous solutions, 18: 25632

AMMAR, M., Radium and Th in water of oil fields, 18: 25696

AMONENKO, V. M., Beryllium and Cr whiskers, 18: 26009

AMRAM, Y., Multiparameter analysis system for data collection and processing, 18: 25820 (NAS-NRC-Pub-1184(p.239-46))

AMSBURY, W. P., X-ray fluorescence tables: LiF crystal, 18: 25330 (Y-1470-C)

AMSBURY, W. P., X-ray fluorescence tables: EDDT crystal, 18: 25449 (Y-1470-D)

AMSDEN, Anthony A., Slip instability, 18: 25667

ANAND, S., Incoherent scattering and polarization of elastic scattering of

γ rays, 18: 26293
ANAND, S., Large-angle Rayleigh scattering of 662-kev γ rays, 18: 26291
ANAND, S., Rayleigh scattering of 662-kev γ rays from different elements, 18: 26292
ANANTHANARAYANAN, K., Photoproduction of charged pions from deuterons, 18: 26317
ANDERSEN, A. C., Effect of x irradiation on reproduction of female beagles, 18: 25092 (UCD-472-109(p.53-61))
ANDERSEN, A. C., Pathology report on experimental beagles, 18: 25093 (UCD-472-109(p.62-172))
ANDERSEN, A. C., Prog. rpt. on long-term effects of x radiation on beagle, annual, 1963, 18: 25088 (UCD-472-109)
ANDERSEN, A. C., Survival of x-irradiated beagles, 18: 25094 (UCD-472-109(p.173-7))
ANDERSEN, S. L., Analysis of γ-γ angular correlation measurements in aligned nuclei, 18: 26637
ANDERSON, W. L., Characteristics of air filter media used for monitoring airborne radioactivity, 18: 26098 (NRL-6054)
ANDO, Wataru, Formation of S compounds in radiolysis of S solution, 18: 25548
ANDO, Wataru, Formation of S compounds in radiolysis of toluene solution of S, 18: 25547
ANDO, Wataru, Radiation-induced reaction of benzyl mercaptan and p-tolyl mercaptan, 18: 25549
ANDO, Wataru, Radiation-induced addition of H sulfide to propylene, 18: 25550
ANDRAS, Karoly, Selecting mass spectrometer, 18: 25772
ANDREADES, S., Fluorocarbanions. Isotopic exchange in monohydrofluorocarbons, 18: 25451
ANDREEV, E. P., Excitation of Balmer series H lines, 18: 26214
ANDREEV, O. L., Efficiency of neutron sources by Au-foil activation method, 18: 26505
ANDREEV, V. G., System for confinement of plasma by field of traveling wave, 18: 26709 (AEC-tr-5589(p.869-87))
ANDREWS, G. A., Clinical bone marrow scanning with radioisotopes, 18: 25238
ANISIMOV, S. I., Temperature and density behind shock wave, 18: 26786
ANKUDINOV, V. A., Excitation of Balmer series H lines, 18: 26214
ANTA, Maria Do Carmo, Radiodosimetry by chemical methods, 18: 25844
ANTOKU, Shigetoshi, Measurement of T(d,n) reaction neutron flux, 18: 26590
ANTONI, G. Degli, Simplest reversible decimal counters, 18: 25755
ANTONOVA, L. I., Lanthanum tellurides, 18: 25430
APPELMAN, E. H., Hydrolysis of XeF_4 and aqueous solution chemistry of Xe, 18: 25357
APPELMAN, Evan H., Characterization of divalent Xe in aqueous solution, 18: 25358
ARAI, Shigeyoshi, Radiolysis of squalane ($C_{30}H_{62}$), 18: 25551
ARAKAWA, E. T., Transition radiation from thin Ag foils, 18: 26224
ARBEL, A. F., Transistorized circuit modules for pulse-height analysis, 18: 25792 (NAS-NRC-Pub-1184(p.79-88))
ARENDT, P. R., Effects of arctic nuclear explosions on satellite radio communication, 18: 26100
ARETOV, G. N., Compression of plasma by rapidly increasing magnetic field, 18: 26698 (AEC-tr-5589(p.565-84))
ARGUE, G. R., Prog. rpt. on radiation effects on electrode behavior, 6–8/63, 18: 26067 (AI-8971)
ARGUE, G. R., Prog. rpt. on solubility and diffusion of ultra-pure transition elements, 12/29/63–3/28/64, 18: 25314 (AI-64-75)
ARIFDZHANOVA, Kh. I., Incorporability of labeled amino acids in protein of animal organism, 18: 25198
ARIMORI, Shigeru, RF-type mouse leukemia induced by radiation, 18: 25226
ARNAO, F. Gil, Properties of Zr and Hf peroxy compound, 18: 25379
ARNELL, S. E., Decays of F-17, Na-21, Al-25, and Al-26m, 18: 26565
ARNOLD, G. P., Magnetic structure of Eu, 18: 26039
ARNOLD, George P., Hydraulic sample changer, 18: 26973
ARNOLD, Richard C., Vector meson exchange model. I., 18: 26342
ARONIN, L. R., Chromium base alloy, 18: 25917
ARONIN, L. R., Prismatic slip in zone-refined Be, 18: 26049
ARTACHO, E., Design and construction of miniature fission chamber, 18: 25860
ARTAUD, J., Analytic problems in U refining industry, 18: 25619
ARTOM, Camillo, Prog. rpt. on aging effect of radiation, final, 12/60–4/64, 18: 25087 (TID-20641)
ARUSHANOV, G. G., Proton Compton scattering according to isobar model, 18: 26298
ASAI, Takeo, ESR of l-cysteine and l-cystine, 18: 25539
ASANO, Yasu, Radiation-induced graft polymerization on polyvinyl alcohol. XVI., 18: 25483 (AEC-tr-6372(p.141-3))
ASCHENBRENNER, R. A., GUS multicomputer system, 18: 25885
ASHBY, John, Methods of making neutron-absorbing devices, 18: 25956
ASHOUR, A. A., Induction of electric currents in an anisotropic ionosphere, 18: 26442
ASHTON, J. W., Jaundice after halothane and radiotherapy, 18: 25119
ASIPOV, K. A., Torsion creep in Ti–Zr alloy, 18: 26011
ASPINALL, A., Level densities of medium mass nuclei, 18: 26597
ASTLEY, E. R., Thermal flux in fuel element of reactor, 18: 26899 (HW-50086)
ASUNDI, R. K., Spectrum of uranyl ion in neutron-irradiated Cs uranyl nitrate, 18: 25554
ATKINSON, G. L., Void fraction measurements in cavitating venturi, 18: 25663
ATKINSON, H. R., Leukemia following irradiation, 18: 25193
AUFIERO, C., Action of P-32 on survival of skin homografts in the rat, 18: 25112
AUFIERO, C., Action of uv rays on survival of homologous skin grafts, 18: 25113
AUFIERO, C., Action of x rays on homologous skin grafts, 18: 25114
AVERIN, V. G., Spectroscopic studies of toroidal discharge, 18: 26792
AXE, J. D., Fluorescence in $Y_2O_3:Eu^{3+}$, 18: 25564
AYSCOUGH, P. B., ESR studies of γ-irradiated olefins and uv-irradiated CH_3I + olefin glasses, 18: 25588
AYUKHANOV, A. Kh., Nonequilibrium evaporation of Ta, 18: 26015
AZZIZ, Nestor, Nuclear matter properties, 18: 26369

B

BAADER, E. W., Occupational cancer, 18: 25211
BABA, M., Design of nuclear electronic devices, 18: 25832
BABIEVSKAYA, I. Z., Yttrium and Gd or La nitrate systems, 18: 25434
BACHMANN, K., Radiochemical study on Zn corrosion, 18: 25927
BACON, T. C., K_1^0 regeneration in hydrogen, 18: 26264 (BNL-837(p.82-7))
BACON, T. C., Observation of reaction $\bar{p} + d \rightarrow \Lambda + \Sigma^- + \Xi^+$, 18: 26334
BACRY, H., Basic SU(3) triplets, 18: 26324
BADELLINO, Fausto, Introduction into portal vein of new colloidal complex labeled with P-32, 18: 25075
BADGLEY, Ronald W., Power-spectral density measurements in a subcritical nuclear reactor, 18: 26970
BAECK, W., Uniform radiation protection, 18: 25733
BAENZIGER, N. C., Structures of Gd_2Al_3, Dy_2Al_3, Gd_5Ge_3, Dy_5Ge_3, and $DyAl_2$, 18: 25989
BAGLIANO, G., Chromatography on ion exchange papers. XII., 18: 25374
BAIR, J. K., Alpha-alpha correlations in $Li^7 + d \rightarrow 2\alpha + n$, 18: 26548 (ORNL-3582(p.99))
BAIR, J. K., Elastic scattering of α particles by O-18, 18: 26645
BAIR, J. K., Proton bombardment of Li-6, Li-7, Be-9, B-11, and O-18, 18: 26601
BAKER, D. W. C., Materials, designs and fabrication techniques in power generating industry, 18: 26946
BAKER, J. H., Adsorption equilibria between earth materials and radionuclides, Cape Thompson, Alaska, 18: 25688 (TID-20638)
BAKER, P. S., Production of Ca-47, 18: 25876 (ORNL-IIC-2)
BAKHTIN, V. D., Measurements of h-f fields in plasma waveguide, 18: 26778
BALAKRISHNAN, P. V., Action of H_2O_2 on Pu solutions, 18: 25390
BALAZS, Louis A. P., Simple *nn* self-consistent calculation, 18: 26331
BALDWIN, David E., Perturbation method for waves in slowly varying plasma, 18: 26747
BALEBANOV, V. M., Motion of individual charged particles in trap, 18: 26702 (AEC-tr-5589(p.637-77))
BALESIN, S. A., Electrochemical behavior of radioactive Fe and steel samples, 18: 25553
BALL, Joseph Andrew, Applications of the Thomas-Fermi atom, 18: 26240

BANDYOPADHYAY, P., Chemistry of lanthanons. XIII., 18: 25389
BANKS, Charles V., Separation of cations by reversed-phase partition chromatography, 18: 25614
BANSAL, B. M. L., Oxalato complexes of Np(IV), 18: 25392
BANTA, H. E., Nanosecond pulsing for Van de Graaff accelerators, 18: 26176
BARABANOV, I. R., Reliability of methods used for study of continuous spectra of fast neutrons and γ quanta, 18: 26120
BARBACCIA, F., Irradiation of the heart with Co-60, 18: 25109
BARBARO-GALTIERI, Angelo, Search for Y_1^1 resonances, 18: 26328
BARBER, R. C., Neutron separation energies for isotopes of Hg, Tl, Pb, and Bi, 18: 26576
BARBESINO, F., Autoclave with forced circulation, 18: 25639 (CISE-99)
BARBIERI, R., Chloride activity in an anion exchange resin, 18: 25297
BARDET, R., Experimental results on plasma acceleration, 18: 26742
BARISH, Barry Clark, Reaction $\pi^- + p \rightarrow \pi^- + \pi^0 + p$, 18: 26377
BARKER, J. A., Calculation of gas transport properties, 18: 26136
BARKER, S. A., Action of γ radiation on liquid ethylene glycol, 18: 25574
BARKER, W. A., Dynamic nuclear orientation for nuclei of spin I = 1, 18: 26598
BARNES, Harley, Geologic map of Paiute Ridge Quadrangle, Nye and Lincoln Counties, Nevada, 18: 26984 (TEI-826)
BARNES, R. F., Total neutron cross section of Cm-244, 18: 26650
BARNES, R. G., Paramagnetic resonance of Fe group elements in rutile. I., 18: 25411
BARNES, R. S., Theory of swelling and gas release for reactor materials, 18: 26080
BAROCAS, Alberto, Ion flotation of inorganic ions. I., 18: 25375
BARON, V. V., Production of high magnetic fields, 18: 26474
BARRAULT, M. R., Azimuthal pinch discharges in H, 18: 26735
BARSUKOV, K. A., Radiation of charge magnetoactive medium, 18: 26791
BARTON, Gilbert Calder, Spatial resolution of external detonation-generated plasmas, 18: 26796
BARTRAM, S. F., Crystallographic data on UO_2WO_4 and UO_2MoO_4, 18: 26118
BARZDO, B. F., Distribution of electron beam energy losses, 18: 26822
BARZDO, B. F., Electrons transmitted by unsupported metal films, 18: 26821
BASHANDY, Ekbal, Half lives of Tb-203 and Tb-201, 18: 26654
BASHANDY, Ekbal, Lifetime of 113-kev first excited level in Hf-177, 18: 26655
BASIN, Ya. N., Actinium–Be sources for industrial geophysical investigations, 18: 25873
BASSICHIS, William H., Boguliubov transformation applied to Bose-Einstein particles, 18: 26436
BATALIN, V. A., Scattering of 0.5- and 0.8-Mev neutrons, 18: 26568
BATCH, J. M., Boiling burnout with fog-cooled 19-rod bundle, 18: 26900 (HW-80523(Rev.1))
BATTAGLIA, G. B., Ovarian function in women treated with Ra, 18: 25196
BATZENSCHLAGER, A., Liver in Lacerta and Accara after ThO_2 injection, 18: 25066
BAUMANN, G., Interactions of 1.5 Bev/c K^- mesons with nuclei, 18: 26636
BAUMANN, Germain, Rate of production and nature of hypernuclei, 18: 26290
BAXENDALE, J. H., Effects of O and pH in radiation chemistry of aqueous solutions, 18: 25580
BAXENDALE, J. H., Redox potential and hydration energy of the hydrated electron, 18: 25581
BAYET, M., Power production through fusion and general properties of plasmas, 18: 26719
BECK, Dorothy, Bibliography on analysis of U, 18: 25263 (AWRE/Lib/Bib/8)
BECK, Harold L., Dose rates from γ radiation in US, 1962–63, 18: 25694
BECK, W. N., Neutron radiographic inspection of irradiated specimens, 18: 26068 (ANL-6799)
BECKER, J. A., Lifetimes of first excited states of O-17 and F-17, 18: 26641
BECKER, R. L., Correlation of Mössbauer isomer shift with residual electrical resistance for Au alloys, 18: 26534 (ORNL-3582(p.16-17))
BECKER, R. L., Wave functions for muon capture in H μ-molecular ion, 18: 26555 (ORNL-3582(p.130))
BECKER, W., Lifetime of $_\Lambda H^3$, 18: 26527 (BNL-837(p.454-6))
BECKERS, J., Identity in theory of collisions, 18: 26287
BEDFORD, Joel S., Survival of HeLa cells irradiated with γ rays, 18: 25187
BEETEM, W. A., Adsorption equilibria between earth materials and radionuclides, Cape Thompson, Alaska, 18: 25688 (TID-20638)
BEETS, C., Neutron propagation in blocks of natural U and steel, 18: 26521
BEG, Mirza A. Baqi, Contribution of charged vector bosons to the photon propagator, 18: 26338
BEHRENDS, R. E., Models for interactions, 18: 26270 (BNL-837(p.266-74))
BEHRMANN, L. A., Stress analysis of filament-wound shell structures, 18: 26115 (SCL-TM-64-53)
BEKHEIT, F., Thorotrast-induced cholangioma, 18: 25147
BELILES, R. P., Behavioral effects in pigeons exposed to Hg vapor, 18: 25057 (UR-645)
BELL, G., Computer techniques, 18: 25881 (NAS-NRC-Pub-1184(p.266-8))
BELL, G., Regional blood flow through the skin, 18: 25070
BELL, G., Time-shared computer for real-time information processing, 18: 25883 (NAS-NRC-Pub-1184(p.271-82))
BELL, K. L., Fine structure of the P-2 terms of the Li isoelectronic sequence, 18: 26231
BELLION, Bartolomeo, Introduction into portal vein of new colloidal complex labeled with P-32, 18: 25075
BELLMAN, Richard, Invariant imbedding theory of neutron transport, 18: 26508
BELLOFATTO, O., Design of boilers for power plants with GCR, 18: 26941
BELLUSCIO, P. R., Behavioral effects in pigeons exposed to Hg vapor, 18: 25057 (UR-645)
BELOV, K. P., Young's modulus anomalies in rare earth ferromagnets, 18: 26006
BELOZERSKII, G. N., Variation of the Mössbauer effect in steel, 18: 25903
BELYAEV, L. M., Triboluminescence in LiF crystals, 18: 25419
BENCZE, Gy., Stripping matrix element with finite range interaction, 18: 26626
BENDER, M. A., Irradiation of donor bone marrow, 18: 25201
BENDISCIOLI, G., Simplest reversible decimal counters, 18: 25755
BENDSCHNEIDER, Kenneth, Beta radiation backscatter gage, 18: 25769
BENEDICT, Ulrich, Plutonium as reactor fuel, 18: 25995
BENET, Y., Vacuum tightness at isotope separation plant, 18: 25682
BENNETT, J. H., Accelerating convergence of discrete-ordinates methods, 18: 26512
BENNETT, William Edward, High voltage generator, 18: 25650
BENSON, Sidney W., Pyrolysis of isopropyl iodide, 18: 25454
BENTON, Edward Everett, Jr., Half life of metastable states of He atom, 18: 26238
BENZCER-KOLLER, N., Internal conversion in Sn-119, 18: 26642
BEREI, K., Production of carrier-free F-18, 18: 25875
BEREZIN, Yu. A., Plasma interactions with h-f field, 18: 26775
BERGE, Ph., Corrosion of C and stainless steels in water and steam. I., 18: 25922 (EURAEC-1038)
BERGER, H., Neutron radiographic inspection of irradiated specimens, 18: 26068 (ANL-6799)
BERGMANN, Peter G., Time symmetry in quantum process of measurement, 18: 26417
BERGQVIST, I., Gamma spectra from resonant neutron capture on F-19, 18: 26541 (ORNL-3582(p.68-71))
BERGQVIST, I., Resonant neutron capture γ spectra from nuclei in s-d shell, 18: 26542 (ORNL-3582(p.71-5))
BERK, Herbert L., Scattering from driven plasma oscillations, 18: 26756
BERLEY, D., Possible violation of $\Delta S = \Delta Q$, 18: 26262 (BNL-837(p.54-65))
BERMAN, I. B., Distribution of dislocations in irradiated crystals, 18: 26082
BERNE, E., Recording rapid changes in radiation intensity, 18: 25051
BERNSTEIN, S., Polarization of totally reflected Mössbauer radiation, 18: 26535 (ORNL-3582(p.20-3))
BERONIUS, Per, Kinetics of isotopic exchange reactions, 18: 25424
BERTOCCHI, L., Bound states and renormalization properties, 18: 26413
BERTOU, P., Study of environmental radioactivity in Venezuela, 18: 25689
BERZINA, I. G., Distribution of dislocations in irradiated crystals,

18: 26082
BETER, E. V., Role of π-π interactions of Ferretti triple pions, 18: 26300
BETOURNE, C., Excitation of levels of O-16 by electron scattering, 18: 26609
BEVAN, E. A., Radio-protective chemicals, 18: 25222
BEVENSEE, R. M., Quantum electrodynamics of stimulated emission of radiation. I., 18: 26399
BEYER, R. T., Magnetically induced sound absorption in liquid Na and K, 18: 26131
BEYSTER, J. R., Neutron thermalization in Zr hydride, 18: 26514
BHARDWAJ, I. S., Disappearance of radicals trapped in γ-irradiated flour, 18: 25123
BHAT, T. R., Studies on EDTA complexes. II., 18: 25380
BHATTACHERJEE, S. B., X-ray fluorescence Pb–U ratio measurements, 18: 25704
BIALECKE, Edward Paul, Jr., Production of high-density gaseous plasmas, 18: 26797
BICE, William O., Process for recovery of yellow cake dust, 18: 25629
BIGELEISEN, Jacob, Isotope effects in phase equilibria, 18: 25373
BIGGERSTAFF, J. A., Gamma spectra from resonant neutron capture on F-19, 18: 26541 (ORNL-3582(p.68-71))
BIGGERSTAFF, J. A., High-resolution neutron total cross sections, 18: 26543 (ORNL-3582(p.75-82))
BIGGERSTAFF, J. A., Resonant neutron capture-γ spectra from nuclei in s-d shell, 18: 26542 (ORNL-3582(p.71-5))
BIGGERSTAFF, J. A., Strength function of isotopes of Zr, 18: 26544 (ORNL-3582(p.82-4))
BILANIUK, O. M., Existence of diprotons using reaction $He^4(d,t)He^3$, 18: 26533 (NP-13974)
BILDSTEIN, H., Analysis of nuclear fuel. I., 18: 25610 (SGAE-CH-4/1964)
BILDSTEIN, H., Analysis of nuclear fuel elements. I., 18: 26903
BILDSTEIN, H., Irradiation capsules for reactor irradiation of organic liquids, 18: 25543
BILES, C. R., Swine exposed to total-body γ irradiation, 18: 25188
BILLETT, Eric Arthur, Improvements in or relating to leak valves, 18: 25652
BILLIGMEIER, J. E., Anodic oxidation of chloride to perchlorate, 18: 25386
BINFORD, F. T., High Flux Isotope Reactor. I., 18: 26962 (ORNL-3572)
BIRD, J. R., Gamma spectra from neutron capture in isotopes of Sn, 18: 26540 (ORNL-3582(p.62-7))
BIRKHOFF, R. D., Transition radiation from thin Ag foils, 18: 26224
BIRKLE, A. J., Thin-foil transmission electron-microscopic study of neutron-irradiated A212B steel, 18: 26092
BISHOP, G. R., Excitation of levels of O-16 by electron scattering, 18: 26609
BISHOP, John, Containers for use in handling radioactive materials, 18: 25736
BISHOP, R. L., Neutron separation energies for isotopes of Hg, Tl, Pb, and Bi, 18: 26576
BISSELL, C. Lynn, Electric conductivity of fused $LiNO_3$–$NaNO_3$–KNO_3 eutectic, 18: 26020
BISSELL, Lynn, Measurement of fused salt conductivity. II., 18: 26019
BLACK, P. J., Elastic nuclear resonant scattering of Fe-57 γ rays, 18: 26657
BLACK, P. J., Nuclear resonant scattering in single crystals, 18: 26656
BLACK, P. J., Scattering of resonant radiation by crystals, 18: 26658
BLAIR, John Austin Iacledon, Improvement in reactor cores, 18: 26848
BLALOCK, T. V., Field effect transistors in low-noise wideband voltage and change-sensitive preamplifiers, 18: 25812 (NAS-NRC-Pub-1184 (p.204-6))
BLANC, Daniel, Distribution of photons and ions along a trajectory in Xe, 18: 26121
BLANCO, R. E., Conversion of radioactive liquid wastes to solids, 18: 26978 (ORNL-TM-857)
BLANN, Marshall, Nuclear shell effects in Ni-58 reactions, 18: 26599
BLANVILLAIN, M., Refining of U at Malvesi plant, 18: 25618
BLASSE, G., Structure and magnetism of $LiGdO_2$ and $NaGdO_2$, 18: 25397
BLAYLOCK, B. Gordon, Chromosomal aberrations in chironomus tentans exposed to radiation, 18: 25212
BLIAUX, J., Thermionic cathodes and magnetron effect, 18: 26256
BLIN, Jean, Magnetically controlled fluid-tight conveying apparatus, 18: 25653
BLOCK, M. M., Capture rate for muons in He-4, 18: 26524 (BNL-837 (p.309-13))
BLOCK, M. M., Lifetime of $_\Lambda H^3$, 18: 26527 (BNL-837(p.454-6))
BLOCK, Richard Blanchard, Electromagnetically driven shock wave, 18: 26795
BLOMEKE, J. O., Conversion of radioactive liquid wastes to solids, 18: 26978 (ORNL-TM-857)
BLOOM, Arthur D., *In vivo* effects of diagnostic x irradiation on human chromosomes, 18: 25163
BLUMENFELD, Henry, Beta decay of Σ^+ and Σ^- hyperons, 18: 26354
BLUMENTHAL, J. L., Prog. rpt. on Be study, 1–3/64, 18: 25328 (SC-DC-64-864)
BLYUMKINA, Yu. A., Instrumentation for control of fast reactor BR-1, 18: 26964
BOATO, G., Solidified inert gases, 18: 25348
BOBASHEV, S. V., Excitation of Balmer series H lines, 18: 26214
BOCCACCI, M., X-ray-induced formation of cysteamine from cystamine, 18: 25542
BOCHENEK, Krystyn, Problems of magnetogasdynamics. I., 18: 26807
BODENLOS, L. J., Swine exposed to total-body γ irradiation, 18: 25188
BODINE, George C., Jr., Prog. rpt. on W sheet rolling, final, 6/60–3/63, 18: 25944 (N63-14854)
BOELLA, G., Simplest reversible decimal counters, 18: 25755
BOFFI, V. C., Exact and asymptotic time-energy distribution of neutrons slowing down, 18: 26501
BOFFI, V. C., Solution of energy-dependent Boltzmann equation, 18: 26500
BOHM, D., Time-energy indeterminacy relation, 18: 26418
BOHN, H. J., Transportable 18-Mev betatron for nondestructive testing, 18: 25677
BOKSHTEIN, S. Z., Internal friction in deformed Mo, 18: 26041
BOLOTIN, L. I., Measurements of h-f fields in plasma waveguide, 18: 26778
BOLOTOVSKII, B. M., Radiation from point charged particle in flight, 18: 26150
BOLTA, J. M., Elastic scattering of deuterons of 10 Mev, 18: 26561
BOLTA, J. M., Interactions on impurities of V target bombarded with deuterons, 18: 26560
BONARD, R. T., Obtaining of Pu tracer in synchrocyclotron, 18: 26169 (NP-13973)
BONDAREVA, T. P., Anodic oxidation of V and Nb, 18: 25929
BONFIELD, W., Transition in microstrain characteristics of Be, 18: 25991
BONNET, Georges, Improvements in fuel rod desheathing machines, 18: 25651
BONSIGNORE, D., Effects of irradiation on the polysaccharide phosphorylase activity in the liver of rats, 18: 25115
BOON, Chie Kim, Fallout, 18: 25698
BOOSS, H.-J., Anodic oxide coatings on W, 18: 25404
BOPP, Charles D., Vibration method for elastic constants of small plates, 18: 25679
BORCHARDT, H. J., Oxidation of Yb, 18: 25930
BORCHERT, W., Sintering processes for Th powder compacts, 18: 25951
BORDES, Gisele, $K^+ + p \rightarrow K^0 + \pi^+ + p$ effective cross section, 18: 26288
BORGERS, E. R., SDS 9300-preliminary specification, 18: 25882 (NAS-NRC-Pub-1184(p.269-70))
BORIANI, A. V., Changes of DNA of guinea pigs subjected to x irradiation, 18: 25102
BORING, J. W., Total ionization in Ar by heavy ions, 18: 26217
BORODIN, P. M., Terrestrial magnetic field measurement using nuclear-resonance filter, 18: 26458
BOROVIKOVA, O. N., Decrease in DNA level of tissue after irradiation of organism, 18: 25137
BORRELLI, F. J., Effects of x irradiation on male fertility in guinea pig, 18: 25191
BORZUNOV, I. A., System for confinement of plasma by field of traveling wave, 18: 26709 (AEC-tr-5589(p.869-87))
BOSCH, J., System of nuclear measuring equipments, 18: 25835
BOSCH, Julius, Gas-flow counter, 18: 25859
BOSCHKE, R. A., Fabrication of collapse clad for Pathfinder, 18: 26914 (ACNP-63031)
BOSE, A. K., Class of solvable potentials, 18: 26412
BOSEVSKI, T., Determination of D_2O–2% enriched U lattice parameters,

18: 26886
BOSTIAN, H., Complex formation in the $Nd(NO_3)_3$–TBP–H_2O system, 18: 25393
BOTHE, Hans-Karl, Analysis of gases and vapors using radiation, 18: 25290
BOTHMA, C. J. C., Separation of Sc from Y, La, and the rare earths, 18: 25613
BOTTEI, R. S., Naphthazarin and β-hydronaphthazarin chelates, 18: 25456
BOUBLIL, Yolande, Propagation of reflected shock wave in transverse magnetic field, 18: 26752
BOUCHE, Liese, Generalization in Einstein-Schroedinger relativistic field theory, 18: 26388
BOULD, Howard, Scintillating anion exchange resin, 18: 25259 (NYO-10405)
BOUNIN, J., Wire chamber—computer system, 18: 25779 (CONF-182-15)
BOWEN, H. C., Hydrogen content of fabricated U, 18: 25943 (HW-30116)
BOWEN, H. J. M., Radioactivation analysis, 18: 25310
BOWEN, I. G., Environmental effects at Hiroshima and Nagasaki, 18: 25722
BOWER, J. R., Waste calcining facility safety analysis, 18: 26977 (IDO-14620)
BOYKO, E. S., Fabrication of collapse clad for Pathfinder, 18: 26914 (ACNP-63031)
BOYLE, W. S., Cytogenic effects of thermal neutron radiation on polyploid gues, 18: 25177
BRACHET, M., Heat transfer by liquid metals, 18: 25661
BRADHURST, D. H., Corrosion research, 18: 25920 (ANL-6868(p.338-54))
BRAHMAVAR, S. M., Interpretation of 5^- levels in even-even nuclei, 18: 26579
BRAHMAVAR, S. M., Mixing ratios (M_1-E_2) in even-even nuclei, 18: 26580
BRAHMAVAR, S. M., Note on M4 transitions, 18: 26208
BRAHMER, Anne, Problems of magnetogasdynamics. I., 18: 26807
BRANDT, F. A., Reactor pressure vessel material surveillance, 18: 26925 (GEAP-4423)
BRAU, Henri, Rate of production and nature of hypernuclei, 18: 26290
BRAUN, H., Interactions of 1.5 Bev/c K^- mesons with nuclei, 18: 26636
BRAUN, Horst, Vanadium, Nb, and Ta metallurgy, 18: 25906
BRAUN, J., MPD power generation studies at AB Atomenergi, 18: 26258
BRAY, P. J., ESR of irradiated alkali borate glasses, 18: 26079
BRECHER, C., Europium chelates as laser materials, 18: 25445
BREGER, A. Kh., Air circulation in operational areas of high-level γ installations, 18: 25718
BREGER, A. Kh., Chemical radiation installation, 18: 25601
BREITBART, Mary Dean Scotus, Dynamic nuclear orientation for nuclei of spin I = 1, 18: 26598
BRESESTI, Marcello, Separation of P-32 from irradiated sulfates, 18: 25615
BRETON, Claude, Dissociation in ionization phenomena of H_2, 18: 26716
BRETON, D., Critical experiments with thermal neutrons, 18: 26874
BRETTON, Randolph H., Free-radical yields in n-alcohols resulting from irradiation, 18: 25538
BREUER, G., Angular distributions and effective cross section of reaction $F^{19}(p,\alpha_0)O^{16}$, 18: 26664
BREWER, C. W., Corrosion prevention in nuclear power industry, 18: 25924
BRIMACOMBE, J. S., Action of γ radiation on liquid ethylene glycol, 18: 25574
BRINEN, J. S., Luminescence of Eu hexafluoroacetylacetonate, 18: 25558
BRIXNER, L. H., Calcium molybdate–rare earth niobate systems, 18: 26017
BRIZEL, H. E., Time-dose relationships in Hodgkin's disease, 18: 25251
BRODY, T. A., 4π Counter with mutual anticoincidence, 18: 25843
BRODZINSKI, R. L., Beta spectrum of Si-32, 18: 26586
BRONFIN, M. B., Internal friction in deformed Mo, 18: 26041
BROOKS, H., Separation of H isotopes during distillation, 18: 25309
BROPHY, J. H., Constitution diagram for system W–Pd, 18: 26023
BROQUET, Claude, Detection of flaws by γ spectrometry, 18: 25676
BROSE, M., Infinite dilute resonance integral of Th, 18: 26621
BROUT, R., Unrealized representations of SU(3), 18: 26355
BROWN, E. B., Nuclear radiation recorder analyzer, 18: 25821 (NAS-NRC-Pub-1184(p.255-65))
BROWN, G., Level densities of medium mass nuclei, 18: 26597
BROWN, Julius, Secondary electron emission, 18: 26156
BROWN, R. R., Ionospheric absorption events in the auroral zone, 18: 26451
BROWN, R. R., Solar-flare α particles, 18: 26445
BROWN, Reynold F., Radiation control: standardization vs freedom, 18: 25248
BROWNE, John H., Nutritional quality of survival biscuits and crackers, 18: 25714
BRUCE, T., Extraction of Pu with triethylene glycol dichloride, 18: 25603 (CEI-18)
BRUGGER, H., Possible violation of $\Delta S = \Delta Q$, 18: 26262 (BNL-837(p.54-65))
BRUN, E., Nuclear magnetic resonance spectrum of B-11 in danburite, 18: 25366
BRUN, E., Nuclear magnetic resonance of La-139 and Al-27 in La aluminate, 18: 26625
BRUNA, J. G., Spectral index measurements in H_2O-moderated bare homogeneous assemblies, 18: 26885
BRUNET, Jean, Distribution of photons and ions along α trajectory in Xe, 18: 26121
BRUNGS, William Aloysius, Jr., Radionuclide distribution in a fresh-water pond, 18: 25079
BRUNNER, J., Power supply of electromagnets, 18: 25642
BRUTTO, E., Autoclave with forced circulation, 18: 25639 (CISE-99)
BRUZEK, Anton, Optical characteristics of cosmic-ray and proton flares, 18: 26193
BRYANT, F. J., Production of defects in CdS by γ rays, 18: 26088
BRYANT, F. R., Radiation damage to transistors, 18: 26091
BRYANT, G. H., Electrostatic plasma resonances, 18: 26763
BRYANT, Terence Graham, Stabilizing devices for bodies located in a channel or bore, 18: 26910
BRYHN-INGEBRIGTSEN, K., Void effects in zero-power critical facility NORA, 18: 26884
BRYLKA, R., Mobile H_2O purification plant, 18: 25726
BRYTOV, I. A., Photoionization absorption cross section of Be, 18: 26215
BRZHECHKO, L. V., Instability of plasma in reflection discharge, 18: 26782
BUCALO, B. J., Dual-purpose operation of the NPR, 18: 26950
BUCCILLI, P. R., Emission of electrons from solids in gas discharges, 18: 26164
BUCCINO, Salvatore George, Scattering of fast neutrons from medium-weight nuclei, 18: 26668
BUCKTON, K. E., Lymphocytes from irradiated patients, 18: 25158
BUGG, W. M., Parity in Σ^- interaction with He, 18: 26278 (ORNL-3582 (p.129))
BUGG, W. M., Search for Λ-nucleon resonance, 18: 26277 (ORNL-3582 (p.127-8))
BUHLER, R. D., Gas flows through electric arcs: hot has containment limits, 18: 26687 (ARL-64-49)
BUIJS, K., Near-infrared bands of H_2O and ionic solutions, 18: 25369
BUJDOSO, E., Radiation protection in industrial application of tracers, 18: 25725
BUKOWSKA, Alina, Titrometric determination of trivalent Ce ions, 18: 25287
BULMER, George Henry, Fire-resisting containers, 18: 26995
BULYGINSKII, D. G., Containment and heating of plasma, 18: 26783
BUNCH, S. M., Interactions of 31-Mev protons with He-4, 18: 26604
BURDETT, John, Improvements in reactor fuelling arrangements, 18: 26847
BURGESS, R. E., Transverse waves along applied magnetic field in plasma, 18: 26713
BURGETT, R., Prog. rpt., 1–3/64, 18: 25269 (NLCO-905)
BURIETYNSKA, K., Change of Lande's interval parameter for U(IV), 18: 25339
BURIKS, Peter, Irradiation arrangement in reactor, 18: 26963 (KFK-tr-139)
BURNELL, Maurice R., Gas chromatography with ionization detector, 18: 25770
BURNETT, D. S., Energy-mass distributions in induced fission, 18: 26558 (UCRL-11377)
BURNETTE, R. D., Catalysis of steam–graphite and CO disproportionation reactions by Ba, Sr, and Cs, 18: 25321 (GA-5215)
BURNS, Victor W., Radioprotection by p-chloromercuribenzoate of yeast, 18: 25224
BURR, John G., Radiolysis of cyclohexane and cyclohexane-d_{12} with benzene and benzene-d_6, 18: 25566

BURRIS, R. W., Lifetime of K_2^0 mesons, 18: 26261 (BNL-837(p.42-52))
BURSHTEIN, E. L., System for confinement of plasma by field of traveling wave, 18: 26709 (AEC-tr-5589(p.869-87))
BURTON, Milton, Diffusion-controlled processes in liquids, 18: 25562
BURTON, Milton, Luminescence quenching in liquid systems, 18: 25563
BUSCAGLIONE, S., Build up factors of J. J. Taylor equation, 18: 26814 (ORNL-tr-80)
BUSSIAN, A. E., Baryon-exchange model in isobar production, 18: 26351
BUSTRAAN, M., Subcritical facility PUK, 18: 26878
BUTCHER, B. R., Mechanical properties of quenched U–Mo alloys. I., 18: 26026
BUTCHER, B. R., Mechanical properties of quenched U–Mo alloys. II., 18: 26027
BUTEMENT, F. D. S., New isotope of Pb: Pb-213, 18: 25869
BUTLER, Thomas Daniel, One-dimensional dense gases with intermolecular potentials, 18: 26110 (LADC-6438)
BUTRYMOWICZ, Daniel B., System Ta–Ti–Zr–O at 1500°C, 18: 26053
BUTSLOV, M. M., Radiation from faintly luminous pulsed plasma, 18: 26743
BYCHKOV, Yu. F., Reversibility of β–ω transformation in Zr–16% Nb alloys, 18: 26003
BYCHKOVA, M. I., Production of high magnetic fields, 18: 26474
BYERS, F. M., Jr., Geologic map of Paiute Ridge Quadrangle, Nye and Lincoln Counties, Nevada, 18: 26984 (TEI-826)
BYGRAVE, W., Coulomb excitation of Se-76 and Se-78 using O ions, 18: 26610

C

CABARET, Jean, Detection of flaws by γ spectrometry, 18: 25676
CABBIBO, Nicola, Leptonic decays in unitary symmetry scheme, 18: 26272 (BNL-837(p.299-302))
CABLE, J. W., Alignment of rare earth moments in dilute Pd–Fe alloys, 18: 25977 (ORNL-3582(p.2-4))
CABLE, J. W., Antiferromagnetism of ordered Pd_2Cr, 18: 25978 (ORNL-3582(p.5-6))
CABLE, J. W., Magnetic properties of intra-rare-earth alloys, 18: 25980 (ORNL-3582(p.9-10))
CABLE, J. W., Magnetic structure properties of rare-earth alloys, 18: 25981 (ORNL-3582(p.11-16))
CADILHAC, M., Spectral index measurements in H_2O-moderated bare homogeneous assemblies, 18: 26885
CAHILL, Laurence J., Jr., Sudden impulses in magnetosphere, 18: 26447
CAILLAT, Roger, Tubular guide and heat-insulator unit for nuclear reactors, 18: 26835
CALDAROLA, Leonardo, Electrical circuits for stepping motors, 18: 25654
CALDAROLA, Leonardo, Introduction into portal vein of new colloidal complex labeled with P-32, 18: 25075
CALDERINI, Paolo, Introduction into portal vein of new colloidal complex labeled with P-32, 18: 25075
CALEY, Wendell Jennison, Jr., High velocity accelerator for small projectiles, 18: 25636
CALLAWAY, Joseph, Theory of scattering in solids, 18: 26212
CALVILLO, J., 4π Counter with mutual anticoincidence, 18: 25843
CAMERON, A. G. W., Particle acceleration in cislunar space, 18: 26195
CAMP, David Conrad, $0^+ \rightarrow 0^+$ positron spectrum in Ga-66, 18: 26669
CAMPAN, J. L., Neutron propagation in blocks of natural U and steel, 18: 26521
CAMPBELL, C. G., Experiment and theory in reactor physics, 18: 26827
CAMPBELL, E. C., Conversion electrons from nuclear states of In excited by (p,n) reactions, 18: 26553 (ORNL-3582(p.115-17))
CANN, G. L., Gas flows through electric arcs: hot gas containment limits, 18: 26687 (ARL-64-49)
CANONICA, C., Effects of irradiation on the polysaccharide phosphorylase activity in the liver of rats, 18: 25115
CAPELLI, L., Changes induced by irradiation on tissues in course of perfusion, 18: 25168
CAPPS, Richard H., Many-particle self-consistent model, 18: 26344
CARDONA, M., Thermodynamic critical field in type-I superconductors, 18: 26480
CARDONA, Manuel, Normal regions in superconducting mixed state, 18: 26489
CAREAGA, J. A., Table of energy vs. magnetic rigidity for He-3, 18: 26232
CAREN, R. P., Radiation effects in spacecraft thermal control materials, 18: 26097
CARFAGNO, Salvatore P., Shock waves propagated through slightly ionized gas, 18: 26802
CARLSON, R. C., Position-sensitive solid-state detector, 18: 25784 (NAS-NRC-Pub-1184(p.42-5))
CARLSON, R. D., Ultra high-speed analyzer-computer, 18: 25818 (NAS-NRC-Pub-1184(p.229-36))
CARLSON, R. R., Iowa four-parameter analyzer, 18: 25822 (NAS-NRC-Pub-1184(p.283-6))
CARLSON, W. D., Effect of x irradiation of bovine testicles on semen, 18: 25185
CARMICHAEL, Halbert Hart, Kinetics of deuterium abstraction, 18: 25261
CARMINATI, V., Phenomenon of secondary tumorigenesis in the rat, 18: 25053
CARROZZINI, B., Adrenosympathetic system in x-irradiated subjects, 18: 25104
CARSON, W. E., Open-loop analog study, 18: 26825 (BAW-1228)
CARSTOIU, John, MHD waves in fluid with uniform rotation, 18: 26714
CASON, Charles, Theory for plasma-filled diodes, 18: 26250 (AD-423080)
CASSAGNOU, Y., Analysis of angular correlations of excitation function, 18: 26634
CASTAGNETO, E., Submarine hulls for nuclear-powered tanker, 18: 2899 (RTI/ING(63)-4)
CASWELL, Hollis L., Thin-film circuit technology. II., 18: 26477
CATALA, J., Elastic scattering of deuterons of 10 Mev, 18: 26561
CATALA, J., Interactions on impurities of V target bombarded with deuterons, 18: 26560
CAUMETTE, P., Neutron propagation in blocks of natural U and steel, 18: 26521
CAVALIERE, R., Changes induced by irradiation on tissues in course of perfusion, 18: 25168
CAVALLI, Adalberto, Introduction into portal vein of new colloidal complex labeled with P-32, 18: 25075
CEDERBERG, J. W., Magnetic resonance with large angular momentum, 18: 26422
CEDERQUIST, Alf Lowell, Electron-nuclear double resonance, 18: 26154
CERMAK, J. O., Pressure drop across thick-plate restrictions, 18: 25665
CERNY, Joseph, Comparison of $O^{18}(p,t)$ and (p,He^3) reactions, 18: 26653
CEROVAC, H., Evaluation of average dose of radiation in occupationally exposed persons, 18: 25717
CHAFFIN, Glenn, Casting W and W–Mo alloys, 18: 25954
CHALLENDER, Ronald Scott, Improvements in nuclear reactors, 18: 2863
CHALLENDER, Ronald Scott, Improvements in nuclear reactors, 18: 2891
CHAMBERLAIN, G. E., Excitation of the 2p state of H, 18: 26225
CHAMBERLAIN, L. L., Atomic vibrations and the melting process in metals, 18: 25990
CHAMBERS, F. W., Jr., Swine exposed to total-body γ irradiation, 18: 25188
CHAMBERS, J. S. W., Jaundice after halothane and radiotherapy, 18: 2511
CHANDRASEKHAR, B. S., Flux jumping and degradation in superconducting solenoids, 18: 26463
CHANG, C. T., Plane perpendicular MGD shocks, 18: 26693 (RISO-70)
CHANG, C. Y., Possible violation of $\Delta S = \Delta Q$, 18: 26262 (BNL-837(p.54-65))
CHANG, Chang W., Radiation effects on nucleic acids during embryonic development. I., 18: 25175
CHANG, Tien-ding, Studies on aneuploids of *Avena sativa* L., 18: 2520
CHANIN, L. M., Ion and electron drift velocities in Cs, 18: 26103 (AROD-3588:2)
CHANIN, Lorne M., Primary ionization coefficient measurements in Penning mixtures, 18: 26220
CHAO, Chia-chang, Area of movement of charged particle in dipole magnetic field, 18: 26117 (JPRS-23767(p.57-61))
CHAO, P. J., Prog. rpt. on coatings for Nb alloys, 12/62–2/63, 18: 2589 (PF-63-3)
CHAPMAN, G. T., Gamma spectra from neutron capture in isotopes of Sn, 18: 26540 (ORNL-3582(p.62-7))
CHAPPEL, Raymond M., High-energy plasma source, 18: 26811
CHARLES, Robert G., Fluorescence properties of Eu dibenzoylmethide, 18: 25455

CHASE, R. L., Information processing systems at Brookhaven, 18: 25743 (NAS-NRC-Pub-1184(p.36-7))
CHATEL, J. L., MC-10 leak detector cell: Helitest 2002, 18: 25761
CHATTERJEE, S. D., Dating of some nuclear explosions from radioactive fallout measurements, 18: 25691
CHAUHAN, U. P. S., Strontium in some Indian vegetables, 18: 25067
CHAUVIN, G., Production of U by electrorefining in molten salt baths, 18: 25399
CHEKA, J. S., Stability of radiophotoluminescence in metaphosphate glass, 18: 26076
CHEKMAREV, I. B., MHD boundary layer on plane, 18: 26787
CHEN, K. L., Reactions of α particles with Sc-45, 18: 26649
CHESNUT, G. F., Gamma-induced decomposition of amides in CCl_4, 18: 25572
CHESSIN, M., Sensitivity of tobacco mosaic virus to fast electrons, 18: 25159
CHEW, H., Production and scattering in simple models. II., 18: 26281
CHICHAGOVA, O. A., Absolute age in Loess soils of Russian Steppe, 18: 25685
CHILD, H. R., Alignment of rare earth moments in dilute Pd–Fe alloys, 18: 25977 (ORNL-3582(p.2-4))
CHILD, H. R., Antiferromagnetism of ordered Pd_2Cr, 18: 25978 (ORNL-3582(p.5-6))
CHILD, H. R., Magnetic properties of intra-rare-earth alloys, 18: 25980 (ORNL-3582(p.9-10))
CHILD, H. R., Magnetic structure properties of rare-earth alloys, 18: 25981 (ORNL-3582(p.11-16))
CHILOSI, G., Decay of the $f_{7/2}$ in Pb-207, 18: 26603
CHIRICO, M., Phenomenon of secondary tumorigenesis in the rat, 18: 25053
CHIRKIN, G. K., Electron paramagnetic resonance of Gd^{3+} in CaF_2, 18: 25416
CHOPPIN, G. R., Near-infrared bands of H_2O and ionic solutions, 18: 25369
CHOU, Kuo-ch'eng, Area of movement of charged particle in dipole magnetic field, 18: 26117 (JPRS-23767(p.57-61))
CHRISTENSEN, Hilbert, Radiolysis of aqueous benzene solutions, 18: 25464 (AE-142)
CHRISTENSON, J. H., K_1-K_2 mass difference, 18: 26263 (BNL-837(p.74-81))
CHRISTIANSON, Charles, Detection of radiations of different energies, 18: 25853
CHRISTOV, S. G., Electrochemical discharge of protons and deuterons, 18: 26209
CHRISTY, R. W., Optical bleaching of V_3 centers in KCl, 18: 26084
CHUNG, Kai-yuan, Van Alphan-de Haas effect for bound electrons, 18: 26393
CHUNG, Suh Urk, Analysis of 1.0- to 1.4-Bev π-p enhancement, 18: 26346
CHUPKA, William A., Ionization and dissociation of polyatomic molecules, 18: 26204
CHURCHILL, R. J., Excitation of m = 0 instabilities in Z-pinch discharge, 18: 26733
CIFALDI, S., Action of P-32 on survival of skin homografts in the rat, 18: 25112
CIFALDI, S., Action of uv rays on survival of homologous skin grafts, 18: 25113
CIFALDI, S., Action of x rays on homologous skin grafts, 18: 25114
CIFKA, J., Phosphorus-32 in neutron-irradiated KCl, 18: 25567
CLAMAN, Henry N., Acquired immunological tolerance in the adult mouse, 18: 25157
CLARK, G. Wayne, Properties of lanthanide germano-molybdates, 18: 25317 (CONF-405-31)
CLARK, R. S., Behavioral effects in pigeons exposed to Hg vapor, 18: 25057 (UR-645)
CLARK, W. E., Conversion of radioactive liquid wastes to solids, 18: 26978 (ORNL-TM-857)
CLARKE, F. J. P., Advances in nuclear ceramics, 18: 26059
CLARKE, R. L., Scattering of 14.1-Mev neutrons from C, Mg, Si, and S, 18: 26600
CLARKE, Winston B., Apparatus for determining γ- or x-ray dosage, 18: 25855
CLEGG, A. B., Reaction $B^{11}(p,p')$ at 150 Mev, 18: 26614
CLENDENIN, W. W., Neutron-pulse parameters in H_2O, 18: 26516
CLESS-BERNERT, T., Pneumatic mixing silo for cement with radioactive substances, 18: 25871 (SGAE-IB/IA-1/1964)
CLIFFORD, C. E., Albedo measurements for 0.66-Mev γ's incident on concrete, Fe, and Pb, 18: 26817
CLINGMAN, D. L., Repetitive pulsed acceleration of plasmas, 18: 26809
COEHOORN, J., Critical facility KRITO, 18: 26883
COFFIN, Lucien, Fuel element loading device for reactor, 18: 26843
COGNE, F., Critical experiments with thermal neutrons, 18: 26874
COHEN, I., Thermal conductivity of oxide fuel elements, 18: 26073 (WAPD-246)
COHEN, Ira, Non-destructive measurement of U-235 in absolute air filters, 18: 25270 (NYO-10726)
COHEN, Lawrence S., Measurement of myocardial blood flow using Kr-85, 18: 25042
COHEN, M. H., New collective resonance in "free-electron" metal, 18: 26226
COHEN, Morrel H., Coherent pairing of second kind, 18: 26426
COHEN, Pierre, Improvements in or relating to ion exchangers, 18: 25262
COHN, Charles Erwin, Errors in noise measurements, 18: 25760
COHN, H. O., Parity in Σ^- interaction with He, 18: 26278 (ORNL-3582 (p.129))
COHN, H. O., Search for Λ-nucleon resonance, 18: 26277 (ORNL-3582 (p.127-8))
COKER, W. R., Helium-3-induced charged-particle reactions, 18: 26549 (ORNL-3582(p.100-1))
COLAMUSSI, V., Adrenosympathetic system in x-irradiated subjects, 18: 25104
COLEDS, Harold John, Improvements in steam turbine systems, 18: 26951
COLEMAN, J., Asymptotic form of impulse approximation electron capture cross section, 18: 26228
COLL, J. A., Deformation mechanisms of beta U single crystals, 18: 26029
COLLE, P., Neutron propagation in blocks of natural U and steel, 18: 26521
COLOMBO, R. L., Activation energy of sintering non-stoichiometric UO_2, 18: 26030
COLOMBO, R. L., Structure of non-stoichiometric UO_2, 18: 25405
COMISKEY, G. F., Ultra high-speed analyzer-computer, 18: 25818 (NAS-NRC-Pub-1184(p.229-36))
COMPOSTELLA, S., Radiochemical study on Fe corrosion, 18: 25926
COMPTON, W. Dale, F-aggregate color centers in KCl, 18: 26087
COMSTOCK, Marjorie, Bibliography on bubble chambers, 18: 25778 (BNL-8083)
CONDON, William J., Dose rates from γ radiation in US, 1962–63, 18: 25694
CONSOLI, T., Experimental results on plasma acceleration, 18: 26742
CONVERSI, M., Radiative muon capture in Ca-40, 18: 26525 (BNL-837 (p.315-23))
CONWAY, D. C., Beta spectrum of Si-32, 18: 26586
COOK, A. J., Structures of Nb–H systems, 18: 26024
COOK, Arthur D., Spark chamber pulser for air-borne use, 18: 25828 (TID-20646)
COOK, J. G., Transverse waves along applied magnetic field in plasma, 18: 26713
COOK, J. R., Chelating tendencies of 2-(pyridyl)-1,3-indanediones, 18: 25457
COOK, Wilfred R., High-energy plasma source, 18: 26811
COOKE, Julian Porch, Indicators of low-intensity chronic γ irradiation effects, 18: 25206
COOKE-YARBOROUGH, E. H., Analog pulse arithmetic by use of logarithmic p-n junctions, 18: 25800 (NAS-NRC-Pub-1184(p.136-9))
COOKE-YARBOROUGH, E. H., Improving low-level linearity of pulse-height-to-time converters, 18: 25806 (NAS-NRC-Pub-1184(p.169-71))
COOKE-YARBOROUGH, E. H., Pulse analysis at Harwell, 18: 25782 (NAS-NRC-Pub-1184(p.15-17))
COOKE-YARBOROUGH, E. H., Use of Atlas on-line, 18: 25880 (NAS-NRC-Pub-1184(p.247-54))
COOKE-YARBOROUGH, E. H., Use of pulse analyzers for measurement of transfer functions by cross-correlation, 18: 25813 (NAS-NRC-Pub-1184 (p.207-9))
COPLEY, D. B., Reactions of Nb and Ta pentachlorides with sulfoxides,

18: 25398
COPPOLA, C., Submarine hulls for nuclear-powered tanker, 18: 26959 (RTI/ING(63)-4)
COPPOLA, M., Action of P-32 on survival of skin homografts in the rat, 18: 25112
COPPOLA, M., Action of uv rays on survival of homologous skin grafts, 18: 25113
COPPOLA, M., Action of x rays on homologous skin grafts, 18: 25114
CORDEY, J. G., Solitary waves in collision-free plasma, 18: 26746
CORIOU, H., Production of U by electrorefining in molten salt baths, 18: 25399
CORTE-REAL, Manoel, Biological action of ionizing radiations, 18: 25105
CORTH, Richard, Radiolysis of normal and secondary butyl chloride, 18: 25598
CORTINI, G., Fission and fragmentation at high energies, 18: 26608
CORUM, J. M., Bowing behavior of fuel elements of EGCR, 18: 26938
COTE, R. E., Total neutron cross section of Cm-244, 18: 26650
COTSAFTIS, M., Marginal stability condition for stationary non-dissipative motions, 18: 26738
COTTINI, C., Timing with semiconductor detectors, 18: 25787 (NAS-NRC-Pub-1184(p.53-8))
COULSON, C. A., Bonding in Xe fluorides, 18: 25372
COURY, F. M., Canonical property and asymptotic reduction procedures, 18: 26313
COWBURN, John Oliver, Improvements in pressurized nuclear reactors, 18: 26840
COX, A. F. J., Production of defects in CdS by γ rays, 18: 26088
COX, A. G., Determination of free I-131 in radioiodinated lipids, 18: 25296
CRAIGMILES, J. P., Gamma irradiation of Rhodesian sundan grass, 18: 25131
CRAINE, L. B., Effects of nuclear testing at medium frequencies, 18: 26454
CRAMER, E. N., High Flux Isotope Reactor. I., 18: 26962 (ORNL-3572)
CRESPI, M. B., Obtaining of Pu tracer in synchrocyclotron, 18: 26169 (NP-13973)
CREVASSE, Lenor E., Buffer distribution in isolated perfused rat heart, 18: 25041
CRISPIN, A., Ionization loss of muons in plastic scintillator, 18: 25842
CRONIN, J. W., K_1-K_2 mass difference, 18: 26263 (BNL-837(p.74-81))
CROSS, David Girdler, Improvements in voluteless centrifugal pumps, 18: 25673
CROSS, W. G., Scattering of 14.1-Mev neutrons from C, Mg, Si, and S, 18: 26600
CROSSLAND, A. D., Production of π mesons by high-energy μ mesons, 18: 26305
CROZAZ, G., Antarctic snow chronology with Pb-210, 18: 25702
CSAKANY, A., Design of nuclear electronic devices, 18: 25832
CSANYI, Piroska, Determination of tritium in form of water and hydrocarbon, 18: 25301
CUEER, Pierre, Rate of production and nature of hypernuclei, 18: 26290
CUER, P., Interactions of 1.5 Bev/c K^- mesons with nuclei, 18: 26636
CULLIGAN, G., Capture rate for muons in He-4, 18: 26524 (BNL-837 (p.309-13))
CUMMING, J. B., Products formed by 2.9-Bev proton irradiation of Ag, 18: 26648
CUNNINGHAM, R. W., Carrier lifetime in InSb high carrier densities, 18: 26106 (D1-82-0306)
CURZON, F. L., Excitation of m = 0 instabilities in Z-pinch discharge, 18: 26733
CZAPLEWSKI, S., Peripheral blood in persons exposed to radiation, 18: 25174

D

DABBS, J. W. T., Fission of oriented nuclei, 18: 26554 (ORNL-3582 (p.121-6))
DA COSTA, R. C. T., Fluctuations in statistical mechanics, 18: 26411
DAHL, Orin I., Analysis of 1.0- to 1.4-Bev π-ρ enhancement, 18: 26346
DALE, T., Military medical services and the physicians, 18: 25729
D'ALESSIO, E., Action of P-32 on survival of skin homografts in the rat, 18: 25112
D'ALESSIO, E., Action of uv rays on survival of homologous skin grafts, 18: 25113
D'ALESSIO, E., Action of x rays on homologous skin grafts, 18: 25114
DALLOS, Andras, Selecting mass spectrometer, 18: 25772
D'AMELIO, C., Gas turbine as auxiliary in BWR plants, 18: 26942
DANELIYA, I. A., Theory of interaction of waves in plasma, 18: 26723
DANIEL, R. C., Thermal conductivity of oxide fuel elements, 18: 26073 (WAPD-246)
DANIELS, A. E., Rubidium-86 uptake by red blood cells, 18: 25074
DANIELS, Robert E., Spark chamber pulser for air-borne use, 18: 25828 (TID-20646)
DANOFSKY, Richard Arlen, Noise analysis in UTR-10 reactor, 18: 26971
DARDER, A., Study of environmental radioactivity in Venezuela, 18: 25689
DAS, Sushil Kumar, Dating of some nuclear explosions from radioactive fall-out measurements, 18: 25691
DA SILVEIRA, R., Evaporation of charged particles, 18: 26629
DAUBER, P. M., K^-p charge-exchange scattering at 1.80 Bev/c, 18: 26339
DAVID, Marshall Earl, Fission of Th by He ions, 18: 26670
DAVIDSON, John K., Mercury–steam binary power cycle, 18: 26949
DAVIS, H. T., Perturbation calculation of mixed-pair correlation functions, 18: 26133
DAVIS, N. O., Transition radiation from thin Ag foils, 18: 26224
DAVIS, W., Jr., Head-end treatments of Purex-1WW waste for fission-product recovery, 18: 25606 (ORNL-3585)
DAVISON, Frederick Corbet, Pathogenesis of Nd oxide in mice and guinea pigs, 18: 25078
DAWSON, J., Comments on h-f conductivity of fully ionized plasma, 18: 26759
DAWSON, J., Plasma stability criteria from conservation laws, 18: 26745
DAY, J. H., Grain-boundary cracking in Mg–Zr alloy, 18: 26032
DAYAL, B., Toya's electron-phonon interaction and lattice vibrations of K, 18: 26142
DEAN, John Robert, Electrical circuits for stepping motors, 18: 25654
DE BELLIS, A., Adrenosympathetic system in x-irradiated subjects, 18: 25104
DE BENEDETTI, Sergio, Nuclear interactions, 18: 26667
DE BREUCK, W., Antarctic snow chronology with Pb-210, 18: 25702
DE CARVALHO, H. G., Fission and fragmentation at high energies, 18: 26608
DECKERS, H., Neutron propagation in blocks of natural U and steel, 18: 26521
DEDEK, W., Reactions of hydrolysis and isomerization of some systox compounds, 18: 25337
DE FRANCISCIS, P., Action of P-32 on survival of skin homografts in the rat, 18: 25112
DE FRANCISCIS, P., Action of uv rays on survival of homologous skin grafts, 18: 25113
DE FRANCISCIS, P., Action of x rays on homologous skin grafts, 18: 25114
DELAFOSSE, J., Vacuum tightness at isotope separation plant, 18: 25612
DELANGE, M., Uranium production plant at Le Bouchet, 18: 25899
DEL FABBRO, R., Two-body effective mass spectra in $\gamma + p \to p + \pi^+ + \pi^-$, 18: 26353
DELL, John David, Tension device for moderator structure, 18: 26852
DELLWEG, Hanswerner, Radiochemical change of halogen–uracil in DNA, 18: 25593
DE LOOSE, R., Radiation as mutagenic agent in fodder crop improvement, 18: 25126
de Lopez, Ma. Esther O.
see Esther O. de Lopez, Ma.
DELPLA, M., Malignant afflictions and weak doses of radiation, 18: 25149
DEL TURCO, Anna Maria, Separation of P-32 from irradiated sulfates, 18: 25615
DELWICHE, J., Influence of instrument factors on measurement of ionization potentials, 18: 25345
de Miranda, Carlos Ferreira
see Ferreira de Miranda, Carlos
DEMIRKHANOV, R. A., Character of instability from interaction of electron beam with plasma, 18: 26706 (AEC-tr-5589(p.767-72))
DEMIRKHANOV, R. A., Charge development in spatially periodic magnetic field, 18: 26705 (AEC-tr-5589(p.758-66))
DENISYUK, S. D., Course of aseptic inflammation of cornea under influence of β particles, 18: 25097 (JPRS-24936)

DE OCAMPO, Geminiano, Basic experiments on cellular death, 18: 25169
DE PASQUALI, G., Solid state and nuclear results from Mössbauer studies with I-129, 18: 26111 (NP-13990)
DE PRETIS, M., Two-body effective mass spectra in $\gamma + p \rightarrow p + \pi^+ + \pi^-$, 18: 26353
DEMGHETTI, B., Nuclear magnetic resonance of La-139 and Al-27 in La aluminate, 18: 26625
DE RINALDIS, P., Polypeptides of the liver in animals subjected to irradiation of the liver, 18: 25110
DESCHREIDER, A. R., Application of extraction and chromatography to flours irradiated by γ rays, 18: 25139
DE SCHRYVER, Ch., Thoracic radioactivity of anesthetized dogs, 18: 25040
DESPOTOVIC, Lj., Evaluation of average dose of radiation in occupationally exposed persons, 18: 25717
DESPRETS, A., Neutron propagation in blocks of natural U and steel, 18: 26521
DETERCK, H., Vacuum tightness at isotope separation plant, 18: 25682
DE TOLLIS, B., Dispersive approach to photon-photon scattering, 18: 26318
DEUTCH, B. I., L-shell particle parameters in 42-kev E3 transition of Ir-191, 18: 26620
DEVANATHAN, V., Note on use of Wick's theorem, 18: 26398
DEVANATHAN, V., Photoproduction of charged pions from deuterons, 18: 26317
DEVIRTS, A. L., Absolute age in Loess soils of Russian Steppe, 18: 25685
DE VAARD, H., Solid state and nuclear results from Mössbauer studies with I-129, 18: 26111 (NP-13990)
DHARMARAJAN, Sangiah, Linear bending analysis of pressurized multicell shell structure, 18: 25633 (ERR-AN-336)
DIAMOND, H., Total neutron cross section of Cm-244, 18: 26650
DIDENKO, A. H., Effects of field cluster on oscillations of particles in accelerators, 18: 26180
DIEBOLD, R., Radiative muon capture in Ca-40, 18: 26525 (BNL-837 (p.315-23))
DIEHES, G. J., Effect of irradiation upon adsorption by alumina catalyst, 18: 25468 (BNL-845)
DIENSTBIER, Z., Using radioactive isotopes in women of childbearing age and pregnant women, 18: 25239
DIETRICH, I., Energy gap of high-field superconductor Nb–Zr, 18: 26481
DIETRICH, K., Binding energies of light hyperfragments, 18: 26591
DIETRICH, O. W., Contamination in crystal monochromatization of neutrons, 18: 26499 (RISO-73)
DIETZSCH, W., Analysis of two-component substances after attenuation of radiation, 18: 26573
DI LELLA, L., Radiative muon capture in Ca-40, 18: 26525 (BNL-837 (p.315-23))
DILLION, M. A., Luminescence quenching in liquid systems, 18: 25563
DILLON, Michael A., Diffusion-controlled processes in liquids, 18: 25562
DIMITRIJEVIC, Z., Spin fluctuation scattering of neutrons on pyrrhotite, 18: 26498 (PAN-280)
DIN, Fan Tsui, Extraction of U(VI) by mono-2,4-diethyloctylorthophosphoric acid, 18: 25623
DIXIT, R. M., Spectrum of uranyl ion in neutron-irradiated Cs uranyl nitrate, 18: 25554
DOBKINA, E. I., Absolute age in Loess soils of Russian Steppe, 18: 25685
DOEHLER, H., Transistorized high-resolution time analyzer, 18: 25753
DOEKVOLD, S., Age to 1.44 ev for (d,d) neutrons in concrete, 18: 26515
DOHERTY, Patrick David, Temperature measurements in hot gases, 18: 26157
DOLGINOV, A. Z., Multiple scattering, 18: 26307
DOLGO-SABUROV, V. B., Decrease in DNA level after irradiation of organism, 18: 25137
DOLL, Hans, Mutation frequency in different spike categories in barley, 18: 25176
DOLLARD, John D., Asymptotic convergence and the Coulomb interaction, 18: 26301
DOMANSKI, T., Metabolism of Sr in adult humans, 18: 25073
DOMAN, H. A., Self-diffusion of Ag in beta AgMg, 18: 26051
DOMINGUES, Louis P., Thermogravimetric analysis of five salts of Pr, Nd, and Sm, 18: 25354
DONGUY, Rene, Monitoring devices for fission products, 18: 26859
DONOVAN, P. F., Excited states of He-4, 18: 26528 (BNL-7983)
DOR, P., Distribution of radioactive I in ovaries, 18: 25120
DOROKHOV, V. I., High-temperature oxidation of Mo silicides, 18: 25928
DOROSHENKO, G. G., Reliability of methods used for study of continuous spectra of fast neutrons and γ quants, 18: 26120
D'ORVAL, C. Closet, Spectral index measurements in H_2O-moderated bare homogeneous assemblies, 18: 26885
DOUBRAVSKY, J., Influence of x irradiation on gastric transit time in rat, 18: 25172
DOUGLASS, D. H., Jr., Tunneling between superconducting films. I., 18: 26487
DOUGLASS, D. H., Jr., Tunneling between superconducting films. II., 18: 26488
DOWIE, James, Improvements in steam turbine systems, 18: 26951
DOWLING, J. H., Swine exposed to total-body γ irradiation, 18: 25188
DRAGANESCU, V., Isotopic structure of the 5535 Å line of BaI, 18: 26213
DRAGANIC, I. G., Determination of CO_2, H_2, and O_2 in aqueous solutions, 18: 25273 (AEC-tr-6227/1(p.9-14))
DRAGULESCU, C., Extraction of Zr–alizarin S complex with butanol, 18: 25306
DRALEY, J. E., Corrosion research, 18: 25920 (ANL-6868(p.338-54))
DRASIL, V., Effects of irradiation on growth of metastases, 18: 25162
DRAYCOTT, A., Fuel element development for gas-cooled reactors, 18: 26905
DREISSIGACKER, H., Material selection for nuclear fuel reprocessing plant dissolver, 18: 25996
DRELL, S. D., Electrodynamic processes with nuclear targets, 18: 26564
DROZDOV, V. E., Chemical radiation installation, 18: 25601
DRUMHELLER, J. E., Nuclear magnetic resonance of La-139 and Al-27 in La aluminate, 18: 26625
D'SILVA, A. P., Premixed, fuel-rich, oxyacetylene flame, 18: 25278
DU BOIS, D. F., Scattering of light by light in plasmas, 18: 26692 (NP-14011)
DU BRIDGE, R. A., Prog. rpt. on in-core instrumentation development, 1–3/64, 18: 25780 (GEAP-4604)
DUBROVSKAYA, L. B., Phase components of Ta–C systems, 18: 26000
DUCKWORTH, H. E., Neutron separation energies for isotopes of Hg, Tl, Pb, and Bi, 18: 26576
DUFTSCHMID, K., Dental fluoroscopy with aid of radiation source, 18: 25234 (SGAE-IB-IA-2/1964)
DUFTSCHMID, K., Pneumatic mixing silo for cement with radioactive substances, 18: 25871 (SGAE-IB/IA/1/1964)
DUGAR-ZHABON, V. D., Space potential plasma disturbed by heterogeneous h-f field, 18: 26776
DUGDALE, R. A., Materials in gas discharges, 18: 26806
DUGGAN, J. L., Helium-3-induced charged-particle reactions, 18: 26549 (ORNL-3582(p.100-1))
DUKE, F. R., Electric conductivity of fused $LiNO_3$–$NaNO_3$–KNO_3 eutectic, 18: 26020
DUKE, F. R., Measurement of fused salt conductivity . I., 18: 26018
DUKE, F. R., Measurement of fused salt conductivity. II., 18: 26019
DUMONT, Allen E., Effect of thorotrast on lymph and serum bilirubin levels, 18: 25060
DUNAITSEV, A. F., Pion beta decay, 18: 26273 (BNL-837(p.344-52))
DUNCAN, E. N., Mutations in cotton induced by γ irradiation of pollen, 18: 25129
DUNCAN, M. M., Helium-3-induced charged-particle reactions, 18: 26549 (ORNL-3582(p.100-1))
DUNGAN, Edward E., Compact lunar power station, 18: 26956 (MTP-ASTR-A-63-8)
DUNSTER, H. J., Discharge of waste from Windscale, 18: 25723
DUPETIT, G. A., Obtaining of Pu tracer in synchrocyclotron, 18: 26169 (NP-13973)
DU PONT, F. M., Dual-purpose operation of the NPR, 18: 26950
DU PREEZ, W. H., Nanosecond pulsing for Van de Graaff accelerators, 18: 26176
DUPUY, Gerard, Support structure for vertical stack of solid moderator, 18: 26842
DURAND, J. P., Thermionic cathodes and magnetron effect, 18: 26256
DUSHIN, L. A., Instability of plasma in reflection discharge, 18: 26782

DUTHIE, Richard E. C., Engineering materials list, 5/64, 18: 26987 (TID-4100(Suppl. 21))
DUTT, N. K., Chemistry of lanthanons. XIII., 18: 25389
DUTTON, David, Improvements in pressurized nuclear reactors, 18: 26840
DYCK, P. L., Chlorophyll mutants in *Avena strigosa* following x irradiation, 18: 25184
DYRSSEN, David, Separation of Eu and Am by solvent extraction, 18: 25622
DYSON, James, Improvements relating to spectrometers, 18: 25764
DZHAFAROV, G. A., Survival rate in acute radiation sickness produced by irradiation with screening of various parts, 18: 25225
DZHRBASHYAN, V. A., Total number of quanta emitted in laminated media, 18: 26297

E

EADES, E. D. M., Action of γ radiation on liquid ethylene glycol, 18: 25574
EARNSHAW, Kenneth B., Propagation of reflected shock wave in transverse magnetic field, 18: 26752
EARWAKER, L. G., States in N-14 near the proton threshold, 18: 26605
EASLEY, Ronald Lester, Diagnosis of plasma cylinders, 18: 26798
EASTHAM, Jerome F., Determination of electron deficiency in Li alkyls, 18: 25452
EBATA, Takeshi, Isobar production in boson-nucleon collision, 18: 26358
EBERHART, James Gettins, Absorption of *ortho*-H and *para*-D on alumina, 18: 25442
EBERLE, A. R., Dissolution and assay of elemental B, 18: 25276
EBERSOLDT, F., Theory of exponential experiments with fast neutrons, 18: 26877
EBERWEIN, Josef, Pressurizer for pressurized water reactors, 18: 26954
ECCLESHALL, D., Coulomb excitation of Se-76 and Se-78 using O ions, 18: 26610
EDERER, David Lothar, Photoionization cross section of Ne, 18: 26239
EDVINSSON, G., Band spectrum of Th oxide, 18: 25407
EDWARDS, C. Lowell, Clinical bone marrow scanning with radioisotopes, 18: 25238
EDWARDS, S. F., Path integrals in polar coordinates, 18: 26427
EFFRON, Edward, Graphite oxidation at low temperature, 18: 25923
EGGEBRAATEN, Vernon L., Beta radiation backscatter gage, 18: 25769
EHRHARDT, H., Charge transfer between O atoms and O^+ and H^+ ions, 18: 25377
EHRMAN, E. F., Electrical connector grounding apparatus, 18: 26996
EICHELBERGER, J. F., Heating vacuum-tube cathodes with Po-210, 18: 25870 (MLM-1154)
EICHELBERGER, R. L., Prog. rpt. on solubility and diffusion of ultra-pure transition elements, 12/29/63–3/28/64, 18: 25314 (AI-64-75)
EICHENBAUM, A. L., Cesium vapor dispenser, 18: 25759
EISLER, F. R., K_1^+ regeneration in hydrogen, 18: 26264 (BNL-837(p.82-7))
EISSENBERG, D. M., Turbulent friction factors of thoria suspensions, 18: 25659
EITINGER, L., Pathologic psychologic reactions to disasters and treatment, 18: 25731
EJIRI, Hiroyasu, Excited states in P-29, 18: 26593
EJIRI, Hiroyasu, Structure of excited states in P-29, 18: 26594
EKREN, E. B., Geologic map of Skull Mountain Quadrangle, NTS, 18: 26985 (TEI-845)
ELBAKYAN, S. S., Radiation of variable moving with constant velocity, 18: 26296
ELDJARN, L., Medical problems resulting from fallout, 18: 25730
ELISEEV, A. A., Lanthanum tellurides, 18: 25430
ELLIOTT, D. M., Out-of-pile temperature evaluation of fission product retention in Na, 18: 25326 (NAA-SR-Memo-9383)
ELLIOTT, William C., Measurement of myocardial blood flow using Kr-85, 18: 25042
ELLIS, G. R. A., External radio emission from earth's outer atmosphere, 18: 26439
EL NADI, Abdel Fattah, Radium and Th in water of oil fields, 18: 25696
EL-NESR, M. S., Lifetime of 113-kev first excited level in Hf-177, 18: 26655
EL-NESR, M. S., Penetration of γ rays in paraffin, 18: 26820
ELSTON, Jean, Tubular guide and heat-insulator unit for nuclear reactors, 18: 26835
ELVING, Philip J., Graphite-indicating electrodes, 18: 25320 (COO-1148-84)
EMELYANOV, V. A., Radioactive ground density meter, 18: 25775
EMERGY, D. A., Breeding value of x-ray induced macromutant. I., 18: 25132
EMERY, V. J., Theories of liquid He-3, 18: 26468
EMMER, T. L., Time discrimination in pulse-height analysis, 18: 25795 (NAS-NRC-Pub-1184(p.112-16))
ENSLEY, George Michael, Improvements in reactor fuelling arrangements, 18: 26847
EMSLEY, George Michael, Thermocouple arrangements for nuclear reactor fuel elements, 18: 25766
ENDO, Tadashi, Combustion method for S determination using S-35, 18: 25302
ENDT, P. M., Spin and parity of the 3.13-Mev level in P-31, 18: 26635
ENGELMANN, Folker, Quantum theory of time measurement. II., 18: 26410
ENGESSER, F. C., Compartmentalization effects on dose rate in radiation field of reactor, 18: 25712 (USNRDL-TR-722)
ENGLER, A., Observation of reaction $\bar{p} + d \rightarrow \Lambda + \Sigma^- + \Xi^+$, 18: 26334
ENGLERT, F., Unrealized representations of SU(3), 18: 26355
ERDELYI, Janos, Selecting mass spectrometer, 18: 25772
ERGUN, Sebri, X rays scattered by polytype-crystalline materials, 18: 26104 (BM-RI-6455)
ERIKSEN, V. O., Void effects in zero-power critical facility NORA, 18: 26884
ERIKSSON, B., Eigenfunctions for the deuteron ground state, 18: 26284
ERNST, S., Structure of uranyl nitrate in organic solvents. II., 18: 25394
EROSHOV, M. E., Chemical radiation installation, 18: 25601
ESPIRITU, Romeo, Basic experiments on cellular death, 18: 25169
ESTHER O. DE LOPEZ, Ma., New level in Na-24, 18: 26659
ETIEVANT, Claude, Thermonuclear energy, 18: 26808
ETO, Kiichi, Excited states in P-29, 18: 26593
EVANS, F. P., Permeation of gases through latex and neoprene, 18: 25215 (AWRE-O-56/57)
EVANS, F. P., Permeability of synthetic rubbers to H, 18: 25467 (AWRE-O-54/57)
EVANS, H. B., X-ray instrument utilizing radioisotope sources, 18: 25275
EVANS, H. E., ESR studies of γ-irradiated olefins and uv-irradiated CH_3I + olefin glasses, 18: 25588
EVANS, P. H., Production problems associated with Be, 18: 25949
EWANIZKY, T., Color center production in $CaF_2:Sm^{++}(Y^{++})$, 18: 26086
EWING, Sylvia B., Radioisotopes procedures manual, 18: 25607 (ORNL-3633)

F

FABRI, G., Current pulses released by Si surface-barrier detectors, 18: 25786 (NAS-NRC-Pub-1184(p.49-52))
FABRI, G., Magnetic quenching of positronium decay in H_2O, 18: 26221
FABRICIUS, Eric, Observations on pigeons with prethalamic radiolesions, 18: 25099
FADDEEV, L. D., Problems in quantum theory of scattering, 18: 26432
FAGGIANI, S., Surface parameters influencing thermal exchanges in boiling, 18: 25670
FAHEY, Walter John, High-ratio mirror coil, 18: 26151
FAIRBROTHER, F., Reactions of Nb and Ta pentachlorides with sulfurous, 18: 25398
FAISSNER, H., Upper limits for anomalous interactions of muon neutrino, 18: 26321
FALCOZ-VIGNE, R., Uranium production plant at Le Bouchet, 18: 25899
FALK, Theodore John, Current-layer diffusion in one-dimensional magnetic pinch, 18: 26804
FARREN, J., Effect of D on photo-oxidation of CH_3I, 18: 25587
FASSEL, V. A., Premixed, fuel-rich, oxyacetylene flame, 18: 25278
FAULKNER, J. S., Electronic states of Kronig-Penney crystal, 18: 26322
FAUSTO, N., Effects of x irradiation on DNA synthesis in mouse spleen, 18: 25186
FAUSTOV, R. N., Quasi-optical potential in quantum field theory, 18: 26410
FEDORCHENKO, V. D., Probe beam investigation of plasma oscillations, 18: 26777
FEDOROV, V. V., Actinium–Be sources for industrial geophysical investi-

gations, 18: 25873
FEIGELSON, R. S., Single-crystal growth of rare-earth orthophosphates, 18: 25356
FEINBERG, G., Field theory of weak interactions, 18: 26267 (BNL-837 (p.237-48))
FEINBERG, G., Mass and interactions of W meson, 18: 26329
FEJER, J. A., Atmospheric tides and associated magnetic effects, 18: 26456
FELLER, H. G., Dimensional changes of Zircaloy-2 and Zr–Nb alloy during annealing, 18: 26028
FENGLER, William W., Port structure for x-ray devices, 18: 26994
FEOFILOV, P. P., Low-temperature spectra of divalent Sm, 18: 25406
FEOFILOV, P. P., Thulium luminescence in fluorite, 18: 25571
FERBERT, H., Fast electron backscattering from 8 to 22 Mev, 18: 26216
FERENDECI, Aitos M., Collective effects on cyclotron radiation in plasma, 18: 26803
FERRARO, V. C. A., Induction of electric currents in an anisotropic ionosphere, 18: 26442
FERREIRA DE MIRANDA, Carlos, Absorption spectra of HF solutions of Fe^{3+}, 18: 25344
FERRIS, L. M., Dissolution of ThO–UO_2 fuel particles in HNO_3–HF solutions, 18: 25608 (ORNL-TM-867)
FETTWEIS, P. F., Conversion electrons from nuclear states of In excited by (p,n) reactions, 18: 26553 (ORNL-3582(p.115-17))
FICK, Eugen, Quantum theory of time measurement. II., 18: 26433
FIEHN, A. J., Dual-purpose operation of the NPR, 18: 26950
FIELD, G. B., Quasi-stellar radio sources as spherical galaxies, 18: 26196
FIELDS, Paul R., Separation of actinides from each other, 18: 25631
FILIPESCU, Nicolae, Spectra and quantum states of Eu β-diketone chelates, 18: 25462
FILIPPOV, I. G., Theory of diffraction of cylindrical shock waves, 18: 26141
FILLIUS, R. Walker, Spectrum of protons in earth's radiation belt, 18: 26244
FILYUSHKIN, I. V., Reliability of methods used for study of continuous spectra of fast neutrons and γ quanta, 18: 26120
FINCH, C. B., Properties of lanthanide germano-molybdates, 18: 25317 (CONF-405-31)
FINCH, Stuart C., Thorium dioxide deposits in human unstained bone marrow smears, 18: 25076
FINK, H. J., Current fluctuations in superconducting circuit, 18: 26484
FINKEL, B. A., Beryllium and Cr whiskers, 18: 26009
FINKEL, J. R., Beta spectrum of Si-32, 18: 26586
FINKEL, V. A., Tempering of Be–Ni alloys, 18: 26005
FISCHBECK, H. J., Decay of Sb-124, 18: 26631
FISCHER, J., Lifetime of K_2^0 mesons, 18: 26261 (BNL-837(p.42-52))
FISHER, P. C., Plastic scintillator response to 1- to 10-kev photons, 18: 25845
FISHER, Philip Andrew, Improvements in Mg-base alloys, 18: 26066
FISHER, Robert, Improvements in fallout shelters, 18: 25681
FISHMAN, Alan M., Non-destructive measurement of U-235 in absolute air filters, 18: 25270 (NYO-10726)
FISK, H. E., Observation of reaction $\bar{p} + d \rightarrow \Lambda + \Sigma^- + \Xi^+$, 18: 26334
FISTER, F., Chemical shifting of Li-7, Na-23, and Rb-87 resonances, 18: 25425
FITCH, V. L., K_1-K_2 mass difference, 18: 26263 (BNL-837(p.74-81))
FITZSIMMONS, D. E., Boiling burnout with fog-cooled 19-rod bundle, 18: 26900 (HW-80523(Rev.1))
FLAD, Dietmar, Precipitation of rare earth metals on Hg cathodes, 18: 25620
FLAMM, E. J., Neutron leakage from interactions of solar protons in the atmosphere, 18: 26446
FLATTAU, J., Decontamination of surfaces contaminated with radioactive isotopes, 18: 25724
FLATTERY, Mark, Emergency field sanitation, 18: 25720
FLEMMING, Ch., Mechanism of the radioprotective action of ethyl palmitate, 18: 25216
FLEMMING, K., Mechanism of the radioprotective action of ethyl palmitate, 18: 25216
FLEMMING, K., Radioprotective action, 18: 25217
FLETCHER, Gilbert H., Dose-time-volume relationship in carcinoma, 18: 25250
FLETCHER, Leslie Maurice, Device for shutting down of nuclear reactors, 18: 26858
FLINT, Oliver, Improvements in plating U with Mg, 18: 25911
FOCHT, Elizabeth F., Radiation effects on cataract production, 18: 25200
FOCK, W., Calculation of gas transport properties, 18: 26136
FOELSCHE, Trutz, Protection against solar flare protons, 18: 26815
FOERSTER, F., Non-destructive testing of reactor components, 18: 25678
FOLK, R., Binding energies of light hyperfragments, 18: 26591
FOMINYKH, V. I., Measurement of efficiency of neutron sources, 18: 26504
FONDA-BONARDI, Giusto, Improvements in plasma accelerators, 18: 26810
FONG, Francis K., Thermal reactions of Dy in CaF_2, 18: 25599
FORD, E. L., Capacitor with an internal gas barrier, 18: 27000
FORD, J. L. C., Coulomb excitation of vibrational triplet states and octupole states in even Cd nuclei, 18: 26551 (ORNL-3582(p.107-11))
FORD, J. L. C., Jr., Elastic scattering of α particles by O-18, 18: 26645
FORESTER, D. W., Hyperfine splitting in alloys of Fe–Rh, 18: 25982 (ORNL-3582(p.18-19))
FORIS, Gabriello, Leukopenia and leukocytosis in parabiotic and whole-body irradiated rabbits, 18: 25150
FORLEO, R., Ovarian function in women treated with Ra, 18: 25196
FORM, G. W., Effects of sintering on the physical and mechanical properties of arc plasma-sprayed W, 18: 26046
FORSTER, H. H., Interactions of 31-Mev protons with He-4, 18: 26604
FORTESCUE, Peter, Nuclear reactor having transfer mechanism, 18: 26862
FOSSAN, D. B., Small-angle elastic scattering of neutrons, 18: 26519
FOSTER, Ellis L., Jr., Improved W electrodes, 18: 25918
FOSTER, Richard A., Gas chromatography with ionization detector, 18: 25770
FOUAD, H., Separation of carrier-free Sc isotopes, 18: 25298
FOWLER, G. N., Production of π mesons by high-energy μ mesons, 18: 26305
FOWLER, J. F., Survival curve shapes for formal multi-target and multi-hit models, 18: 25171
FOWLER, J. L., Interaction of neutrons with Pb-208, 18: 26545 (ORNL-3582(p.86-90))
FOWLER, J. L., Scattering of 3- to 4-Mev neutrons from O-16, 18: 26546 (ORNL-3582(p.90-2))
FRADKIN, D. M., Coulomb scattering of Dirac particles, 18: 26279
FRADKIN, D. M., Method of asymptotic expansion of Fourier-type integrals, 18: 26280
FRADKIN, G. M., Actinium–Be sources for industrial geophysical investigations, 18: 25873
FRAHN, W. E., Model for elastic nuclear scattering and polarization of spin-½ particles. II., 18: 26562
FRAHN, W. E., Model for elastic nuclear scattering and polarization of spin-½ particles. III., 18: 26563
FRANK, L. A., Earth's outer radiation zone, 18: 26444
FRANK-KAMENETSKII, D. A., Propagation of EM waves in plasma along magnetic field, 18: 26699 (AEC-tr-5589(p.596-611))
FRANK-KAMENETSKII, D. A., Theory of magnetoacoustic resonance in plasma, 18: 26700 (AEC-tr-5589(p.612-25))
FRANKLIN, R. N., Electrostatic plasma resonances, 18: 26763
FRANKS, L. A., Oxygen bleaching of γ-induced absorption bands in polystyrene, 18: 25568
FRANTZ, L. M., High-intensity quantum electrodynamics. I., 18: 26419
FRANZ, K., Fast binary analog-to-digital converter, 18: 25807 (NAS-NRC-Pub-1184(p.172-6))
FRAZER, William R., S-matrix poles close to threshold, 18: 26330
FREDERICK, E. J., Conversion of radioactive liquid wastes to solids, 18: 26978 (ORNL-TM-857)
FREDERKING, T. H. K., Metastable superheat in nucleate boiling of cryogenic liquids, 18: 26461
FREEMAN, John Wright, Jr., Electron distribution in the outer radiation zone, 18: 26246
FREIWALD, H., Microwave investigations of gas-detonation plasmas, 18: 26765
FRENCH, R. L., Air/ground interface effects on fast-neutron distributions, 18: 26511
FREUND, M., Effects of x irradiation on male fertility in guinea pig, 18: 25191

FRICK, Henry Clay, II, Complications following radiotherapy, 18: 25167
FRICKE, Hugo, Pulsed electron beam kinetics, 18: 25578
FRICKEN, Raymond Lee, Interactions of heavy nuclei, 18: 26378
FRID, S. A., Pressure and composition of vapor in KCl systems with Sm, Y, Ca, and Sr, 18: 25435
FRIDMAN, A. M., Heterogeneous plasma stability in magnetic field, 18: 26767
FRIED, Ilona, Graphite-indicating electrodes, 18: 25320 (COO-1148-84)
FRIEDES, J. L., Multiple scattering corrections, 18: 26530 (BNL-8028)
FRIEDLAND, Stephen S., Linear semiconductor junction radiation detector, 18: 25858
FRIEDMAN, E., Studies of neutron thermalization in H_2O, 18: 26871
FRIEDMAN, Herbert, X-ray astronomy, 18: 26200
FRIEMAN, E., Kinetic theory of weakly unstable plasma, 18: 26712
FRITZ, James S., Separation of Mo in steels, 18: 25280
FROESE-GERTZEN, Edith E., Mutation rate in barley, 18: 25182
FRYDENBERG, Ove, Mutation frequency in different spike categories in barley, 18: 25176
FUBINI, S., Bound states and renormalization properties, 18: 26413
FUCCILLO, D. A., Jr., Radioisotopes procedures manual, 18: 25607 (ORNL-3633)
FUJII, T., Lifetime of K_2^0 mesons, 18: 26261 (BNL-837(p.42-52))
FUJII, Toshikatsu, Polymerization of acrolein initiated by γ rays, 18: 25546
FUJITA, Jun-Ichi, Conserved vector current theory in forbidden β transitions, 18: 26526 (BNL-837(p.340-3))
FUJIWARA, Kikuo, Radiation-induced polymerization of ketene types. I., 18: 25493 (AEC-tr-6372(p.223-35))
FUJIWARA, Kikuo, Radiation-induced polymerization of ketene types. II., 18: 25494 (AEC-tr-6372(p.237-46))
FUKAI, Mosakazu, Line-broadening due to ionized impurity scattering in Ge, 18: 26112 (NP-14017)
FUKETA, T., Nuclear radii of isotopes of Sn, 18: 26538 (ORNL-3582 (p.56-7))
FULLERTON, Richard, Removing Ru from aqueous solutions, 18: 25632
FUMAROLA, D., Chemical and biological protection against radiations. IV., 18: 25218
FURLAN, G., Bound states and renormalization properties, 18: 26413
FURLONG, LeRoy R., Thermogravimetric analysis of five salts of Pr, Nd, and Sm, 18: 25354
FURUKAWA, Kiyoshi, Radiolysis of squalane ($C_{30}H_{62}$), 18: 25551

G

GABLER, Ed., Fertility of guinea pigs after whole-body x radiation, 18: 25230
GABOR, John D., Lateral solids mixing in fluidized-packed beds, 18: 25658
GABOVICH, M. D., Penetration of plasma from source with electron oscillations to evacuated region with magnetic field, 18: 26711 (FTD-TT-64-400)
GAGE, Andre H., Mercury–steam binary power cycle, 18: 26949
GAJEWSKI, Ryszard, Problems of magnetogasdynamics. I., 18: 26807
GALECHYAN, G. A., Distribution of partial pressure of negative ions in discharge column, 18: 26720
GALECHYAN, V. V., Distribution of partial pressure of negative ions in discharge column, 18: 26720
GALLAWAY, William S., Gas chromatography with ionization detector, 18: 25770
GALLINA, F., Effect of bleeding on the whole-body irradiated animal, 18: 25116
GANG, Robert E., Superconducting magnets, 18: 26478
GANGADHARAN, P., Photovoltaic cell x-ray exposure rate meter, 18: 25867
GARCIA, A., Elastic scattering of deuterons of 10 Mev, 18: 26561
GARCIA, A., Interactions on impurities of V target bombarded with deuterons, 18: 26560
GARCZYNSKI, W., Condition for field to be generalized free field, 18: 26402
GARIBYAN, G. M., Radiation of variable moving with constant velocity, 18: 26296
GARLAND, L. Henry, Radiation protection procedures, 18: 25247
GARLICK, G. F. J., Production of defects in CdS by γ rays, 18: 26088
GARNER, R. J., Calculation of radiation doses to GI tract to ruminants, 18: 25142
GARNER, R. J., Discharge of waste from Windscale, 18: 25723
GARRISON, Warren M., Actions of ionizing radiations on N compounds in aqueous media, 18: 25583
GASPARINI, C., Autoclave with forced circulation, 18: 25639 (CISE-99)
GASSNER, F. X., Effect of x irradiation of bovine testicles on semen, 18: 25185
GAST, Paul F., Heterogeneous resonance capture, 18: 26870
GASTWIRTH, Joseph Lewis, Theory of particle counting, 18: 25890
GATTI, E., Current pulses released by Si surface-barrier detectors, 18: 25786 (NAS-NRC-pub-1184(p.49-52))
GATTI, E., Timing with semiconductor detectors, 18: 25787 (NAS-NRC-Pub-1184(p.53-8))
GAUSSENS, J., Economy of nuclear fuels, 18: 26904
GAVER, R. W., Synthesis of C-deuterated ethylenediamine dihydrobromide, 18: 25458
GAZZINELLI, Ramayana, Exchange polarization of the self-trapped hole in LiF, 18: 25414
GEARY, A. L., Chromium base alloy, 18: 25917
GEARY, A. L., Tungsten alloys containing Re, 18: 25976 (NMI-1261)
GEBHART, B., Transient forced convection from flat plate, 18: 25666
GEE, Harry Y., Scintillating anion exchange resin, 18: 25259 (NYO-1048)
GEIGER, K. W., Neutron spectrum of an Am^{241}–Be(α,n) source, 18: 26510
GEL'D, P. V., Phase components of Ta–C systems, 18: 26000
GELLER, B. A., Use of N-15 in investigating role of Cu in plant assimilation of ammonia and nitrate N, 18: 25059 (OTS-63-11008(p.1-10))
GELLER, R., Experimental results on plasma acceleration, 18: 26742
GENOLIO, Raymond Joseph, Renormalization in stochastic theory, 18: 26437
GEPPERT, Donovan V., Solutions to Maxwell-Lorentz equations, 18: 26416
GERBER, Jean-Paul, Rate of production and nature of hypernuclei, 18: 26290
GERE, E. A., Nuclear radiation recorder analyzer, 18: 25821 (NAS-NRC-Pub-1184(p.255-65))
GERJUOY, Edward, Self-confinement of plasmas, 18: 26758
GERMAI, Georges, Study of scintillating gels, 18: 25864
GERRARD, Martha, Production of Cu-47, 18: 25876 (ORNL-IIC-2)
GERVORKOV, A. K., Character of instability from interaction of electron beam with plasma, 18: 26706 (AEC-tr-5589(p.767-72))
GESSAROLI, R., Lifetime of $_{\Lambda}H^3$, 18: 26527 (BNL-837(p.454-6))
GETOFF, N., Analysis of nuclear fuel. I., 18: 25610 (SGAE-CH-4/1964)
GETOFF, N., Analysis of nuclear fuel elements. I., 18: 26903
GEY, Albert, Determining proportion of simultaneously emitted neutrons, 18: 25857
GEYER, H., Influence of x rays on pyridoxal phosphate in *E. coli*, 18: 25103
GHATAK, Ajoy, Simple binary collision model for Van Hove's $G_s(r,t)$, 18: 26421
GHIELMETTI, F., Quantum theory of interference of light from two lasers, 18: 26425
GHIRARDI, G. C., Properties of a class of nonlocal solvable interactions, 18: 26404
GHOSE, Subrata, Nuclear magnetic resonance spectrum of B-11 in danburite, 18: 25366
GIAMATI, C. C., Visible radiation damage effects of 40-Mev α particles on NaCl crystals, 18: 26071 (NASA-TN-D-2329)
GIANNINI, R., First "fast burst" occurring in Latina reactor, 18: 26922 (EUR-1810.i(Paper 5))
GIBBONS, D., Radioactivation analysis, 18: 25310
GIBBONS, F. L., Magnetic shielding and superconductivity, 18: 26107 (ERR-FW-210)
GIBBONS, J. H., Gamma spectra from resonant neutron capture on F-19, 18: 26541 (ORNL-3582(p.68-71))
GIBBONS, J. H., High-resolution neutron total cross sections, 18: 26543 (ORNL-3582(p.75-82))
GIBBONS, J. H., Resonant neutron capture γ spectra from nuclei in s-d shell, 18: 26542 (ORNL-3582(p.71-5))
GIBBS, G. B., Melting parameters of cubic metals, 18: 25994
GIESSEN, B. C., Intermediate phases in systems of Nb or Ta with Rh, Ir, Pd, or Pt, 18: 25988

GIESSEN, Bill C., Constitution diagram for Ta–Rh, 18: 26048
GILBERT, J. R., Effect of D on photo-oxidation of CH_4, 18: 25587
GILINSKY, V., Scattering of light by light in plasmas, 18: 26692 (NP-14011)
GILL, D. M., Use of glass fiber paper in liquid scintillation counting, 18: 25839
GILLESPIE, John Raymond, Effects of final-state interactions on scattering processes, 18: 26379
GILLETTE, E. L., Effect of x irradiation of bovine testicles on semen, 18: 25185
GILLIGAN, J. E., Radiation effects in spacecraft thermal control materials, 18: 26097
GIORDANO, D., Chemical and biological protection against radiations. IV., 18: 25218
GIRARD, Y., Critical experiments with thermal neutrons, 18: 26874
GIRNIK, D. V., Use of isotopes in investigation of flowering and nectar formation in linden trees, 18: 25058 (OTS-63-11008(p.1-5))
GJOETTERUD, K., Analysis of γ-γ angular correlation measurements in aligned nuclei, 18: 26637
GLADYSHEVSKII, E. I., Crystal structure of Ta_2Ge_3, 18: 26043
GLAGOLEV, V. I., Reliability of methods used for study of continuous spectra of fast neutrons and γ quanta, 18: 26120
GLASKO, V. B., Motion of individual charged particles in trap, 18: 26702 (AEC-tr-5589(p.637-77))
GLASSNER, Alvin, Conference on mechanisms in radiation chemistry of aqueous media, Gatlinburg, 5/63, 18: 25575
GLAUERT, M. B., MHD flows with aligned magnetic fields, 18: 26126
GLAUNER, R., Results of medical radiation research. I., 18: 25256
GLAZOV, A. N., Use of radioactive isotopes in surveys for engineering structures, 18: 25699 (OTS-63-11008(p.15-21))
GLUSHKO, P. I., High-temperature oxidation of Mo silicides, 18: 25928
GNEDIN, Yu. N., Multiple scattering, 18: 26307
GOBBI, Bruno, Angular correlations (p,p,γ) on Zn isotopes, 18: 26582
GODART, O., Modification of method of adelphic integral, 18: 26242
GODBEE, H. W., Conversion of radioactive liquid wastes to solids, 18: 26978 (ORNL-TM-857)
GODE, H., Lithium tetraborate, 18: 25331 (AWRE-Trans-43)
GODELLE, M., Shutdown of D_2O reactor by sudden reactivity variation, 18: 26864 (EUR-548.f)
GODNEVA, M. M., Electrolytic deposition of Ni with Nb, Ta, Ti, and Zr from anhydrous solutions, 18: 26057
GOEDKOOP, J. A., Laboratory experiments at high-flux reactor, 18: 26965
GOETZ, W. K., Constitution diagram for system W–Pd, 18: 26023
GOLDHAMMER, Poul, Variational treatment of hard-core interactions, 18: 26306
GOLDMAN, Max, Prediscbarges under very low pressures, 18: 26715
GOLOVANIVSKII, K. S., Space potential plasma disturbed by heterogeneous b-field, 18: 26776
GONZALEZ RINCONES, P., Effects of total-body irradiation. II., 18: 25140
GOOD, W. M., Gamma spectra from resonant neutron capture on F-19, 18: 26541 (ORNL-3582(p.68-71))
GOOD, W. M., High-resolution neutron total cross sections, 18: 26543 (ORNL-3582(p.75-82))
GOOD, W. M., Nanosecond pulsing for Van de Graaff accelerators, 18: 26176
GOOD, W. M., Reactions $Mg(\alpha,\alpha)Mg^{24}$ and $Mg^{24}(\alpha,\alpha')Mg^{24m}$, 18: 26550 (ORNL-3582(p.101-2))
GOOD, W. M., Resonant neutron capture γ spectra from nuclei in s-d shell, 18: 26542 (ORNL-3582(p.71-5))
GOOD, W. M., Strength function of isotopes of Zr, 18: 26544 (ORNL-3582 (p.82-4))
GOODFELLOW, H., Zero-energy fast reactor VERA, 18: 26876
GOODINGS, A., Metals for construction of wide-range ionization chamber, 18: 25776 (AEEW-M-381)
GOODINGS, A., Saturation characteristics of He in d-c fission chamber, 18: 25777 (AEEW-M-395)
GOODMAN, Joan Wright, Irradiation of donor bone marrow, 18: 25201
GORBUNOV, L. M., Transport in nonisothermal ionized plasma, 18: 26769
GORDIEVSKII, A. V., Extraction of U(VI) by mono-2,4-diethyloctylorthophosphoric acid, 18: 25623
GORDON, S., Radiation chemistry of single-C compounds and reactions of hydrated electron, 18: 25579
GORELIK, L. L., Bolometric determination of plasma energy losses, 18: 26779
GORELIK, L. L., Triple-layer bolometers for measuring plasma energy losses, 18: 26780
GORLIN, Richard, Measurement of myocardial blood flow using Kr-85, 18: 25042
GOTOW, K., Reduced energy spread of synchrocyclotron beams, 18: 26177
GOTSMAN, E., Bootstrap calculation for the Z^- mass, 18: 26315
GOTT, Yu. V., Measurement of energy of ions in trap with magnetic mirrors, 18: 26701 (AEC-tr-5589(p.626-36))
GOULDING, F. S., Linear amplifier, gating and timing system, 18: 25799 (NAS-NRC-Pub-1184(p.124-34))
GOULDING, F. S., Low-noise pre-amplifier for use with semiconductor detectors, 18: 25789 (NAS-NRC-Pub-1184(p.61-4))
GOULDING, F. S., Phototube noise rejection using pulse cross-over technique, 18: 25802 (NAS-NRC-Pub-1184(p.143-5))
GOULDING, F. S., Series-parallel transistor switch as linear gate, 18: 25798 (NAS-NRC-Pub-1184(p.121-3))
GOULDING, F. S., Timing using semiconductor detectors, 18: 25788 (NAS-NRC-Pub-1184(p.59-60))
GOVAERTS, P., Theory of exponential experiments with fast neutrons, 18: 26877
GRACZYK, Jan, Thermostat with 0.0005° regulation accuracy, 18: 25750 (PAN-459/XVI)
GRAFTIEAUX, Jean, Monitoring devices for fission products, 18: 26859
GRAHAM, M., Standardization [of instruments], 18: 25814 (NAS-NRC-Pub-1184(p.210-11))
GRANT, N. J., Intermediate phases in systems of Nb or Ta with Rh, Ir, Pd, or Pt, 18: 25988
GRANT, Nicholas J., Constitution diagram for Ta–Rh, 18: 26048
GRASSINI, G., Chromatography on ion exchange papers. XII., 18: 25374
GRAUL, E. H., Relative biological effectiveness of neutrons. IV., 18: 25107
GRAY, Alan Lyle, Determining ash content of coal, 18: 25311
GREENBERG, W. M., Decay of Sb-124, 18: 26631
GREENE, Norman D., Fuel channel elements for circulating fuel reactors, 18: 26857
GREENFIELD, P., Comparison of Magnox A12 and ZA alloys as canning materials, 18: 26025
GREENING, J. R., Saturation characteristics of parallel-plate ion chambers, 18: 25840
GREGG, R. A., Cellular precipitation in Nb–Cr alloys, 18: 26022
GREGORY, J. B., Twenty-seven-day recurrence of solar protons, 18: 26243
GREGORY, W. C., Breeding value of x-ray induced macromutant. I., 18: 25132
GRENIER, George, Heat capacities of solid D, 18: 25365
GRIBOV, V. N., High-energy behavior of elastic scattering amplitude, 18: 26322
GRIFFIN, P. M., Optical physics, 18: 26114 (ORNL-3582(p.36-7))
GRIFFITHS, John, Detection of the escape of fission products, 18: 25856
GRIGOR'EV, A. T., Phase transformations in V–Ta alloys, 18: 26055
GRIGOR'EVA, E. F., Salts of dialkyl phosphoric, 18: 25429
GRIGORY, S. C., Fatigue strength of pressure vessels, 18: 25680 (TID-20648)
GRIGOR'YANTS, A. G., Equations for π-N scattering at low energies, 18: 26299
GRIMELAND, B., Age to 1.44 ev for (d,d) neutrons in concrete, 18: 26515
GRIMELLINI, L., Lifetime of $_\Lambda H^3$, 18: 26527 (BNL-837(p.454-6))
GRIMES, W. R., Molten salts as reactor materials, 18: 26937
GRIN, Yu. T., Angular anisotropy of fission fragments, 18: 26627
GRIN, Yu. T., Intensity ratios of electromagnetic transitions, 18: 26628
GRISHANIN, E. I., Calculation of effectiveness of multilayer control rods, 18: 26831
GRISHANIN, E. I., Effectiveness of control rods containing moderating material, 18: 26832
GROSS, Gordon E., Physical basis of mechanical properties of ceramics, 18: 25973 (ASD-TDR-63-605(Pt.II))
GROVER, J. Robb, Formation of compound nucleus Po-210 in systems $Pb^{208} + \alpha$ and $Bi^{209} + p$, 18: 26647
GRUBER, Ulf, Gamma radiation from capture of thermal neutrons in Rh, 18: 26666

GRUENHUT, E., Gamma-induced decomposition of amides in CCl_4, 18: 25572
GRUNDY, K. H., Reactions of Nb and Ta pentachlorides with sulfoxides, 18: 25398
GUBBINS, D. G., Repetitive pulsed acceleration of plasmas, 18: 26809
GUBBIOTTI, A., Effect of bleeding on the whole-body irradiated animal, 18: 25116
GUERNSEY, Ralph, Comments on h-f conductivity of fully ionized plasma, 18: 26759
GUERNSEY, Ralph L., Kinetic theory of classical electron gas. I., 18: 26748
GUILBARD, C., Vacuum tightness at isotope separation plant, 18: 25682
GULYAEV, Y. V., Path integrals in polar coordinates, 18: 26427
GULYAMOV, U. G., Role of π-σ interactions of Ferretti triple pions, 18: 26300
GUNZ, F. W., Leukemia following irradiation, 18: 25193
GUPTA, Ashok Kumar, Electronic thermal conductivity of superconductors, 18: 26486
GUPTA, M. M., Optimum shape of shielding barrier for disc source, 18: 26818
GUR'EV, M. V., Effect of Co-60 γ radiation on alkaline anion-exchange resins, 18: 25541
GUR'EV, M. V., Measurements of kinetic energy of fragment ions, 18: 25763
GUSTINCIC, Jacob Joseph, Two-temperature Maxwellian plasma, 18: 26801
GUTHRIE, C. E., Possibilities and consequences of major accidents in fuel fabrication and radioisotope processing plants, 18: 25711 (ORNL-3441)
GUTKIN, T. I., Charge development in spatially periodic magnetic field, 18: 26705 (AEC-tr-5589(p.758-66))
GUTKIN, T. I., Plasma interactions with h-f field, 18: 26775
GUTSHALL, Paul L., Physical basis of mechanical properties of ceramics, 18: 25973 (ASD-TDR-63-605(Pt.II))
GUYENOT, Ernst, Recording devices for corpuscular radiation, 18: 25771
GYUK, I. P., Meson-baryon systems and their resonances, 18: 26332
GZELISHVILI, M. S., Ascorbic acid content in brain tissue of dogs with acute radiation sickness, 18: 25161

H

HAARRING, R. J., Sensitivity of castorbean to γ rays, 18: 25180
HABERMANN, Clarence Edward, Vapor pressures of rare earth metals, 18: 26062
HACHIHAMA, Yoshikazu, Polymerization of acrolein initiated by γ rays, 18: 25546
HACKNEY, Stanley, Improvements relating to nuclear reactors, 18: 26890
HACSKAYLO, Michael, Visible radiation damage effects of 40-Mev α particles on NaCl crystals, 18: 26071 (NASA-TN-D-2329)
HAEBLER, Dietrich v[on], Safety systems for power reactors, 18: 26935
HAENSEL, H. D., Irradiation-induced mutations in sorghum, 18: 25130
HAESAENEN, Erkki, Body burden of Cs-137 in people of Southern Finland 1961–1963, 18: 25687 (NP-13981)
HAFEMEISTER, D. W., Solid state and nuclear results from Mössbauer studies with I-129, 18: 26111 (NP-13990)
HAFER, J. F., Open-loop analog study, 18: 26825 (BAW-1228)
HAFNER, Stefan, Nuclear magnetic resonance in molten salts. I., 18: 25361
HAFNER, Stefan, Probes for high-temperature NMR, 18: 25758
HAGGERTY, Maureen, Determination of electron deficiency in Li alkyls, 18: 25452
HAGSTROEM, S., Electron spectroscopy for chemical analyses, 18: 25303
HAHN, Eberhard, Recording devices for corpuscular radiation, 18: 25771
HAHNE, Rolf Mathieu August, Effects of $Br^{80m} \xrightarrow{IT} Br^{80}$ and $Br^{82}(n,\gamma)Br^{83}$ in condensed organic media, 18: 25596
HAIGH, J. G. B., Level densities of medium mass nuclei, 18: 26597
HAJDUKOVIC, S. I., Effects of whole-body and local x irradiation on reproductive ability, 18: 25215 (AEC-tr-6227/1(p.25-44))
HAJEK, V., Film dosimetry in a radiology department, 18: 25721
HAKIM, E. B., Effects of neutron radiation on secondary breakdown, 18: 25756
HALL, Eric J., Survival of HeLa cells irradiated with γ rays, 18: 25187
HALL, Harry Thomas, Powders for extinguishing fires, 18: 25737
HALL, W. F., Thermodynamic properties of Li and Mg halides, 18: 25360
HALLBERG, L., Recording rapid changes in radiation intensity, 18: 25651
HALLOWELL, Stanley, Improvements in pliable sheeting for sound proofing and other purposes, 18: 25909
HALPERN, Alvin, μ^- Capture rate in (pμp), 18: 26345
HALPERN, Jules, Rare decays of the μ meson, 18: 26356
HALVERSON, F., Luminescence of Eu hexafluoroacetylacetonate, 18: 25558
HAMA, Mitsuru, Theory of weak interaction, 18: 26362
HAMADA, Hakuo, Radiation-induced polymerization of vinylene type monomers, 18: 25491 (AEC-tr-6372(p.207-12))
HAMADA, Hakuo, Radiation-induced polymerization of phosphonitrile chloride, 18: 25496 (AEC-tr-6372(p.261-72))
HAMAGUCHI, Y., Neutron-diffraction investigation of Cr alloys, 18: 25979 (ORNL-3582(p.7-8))
HAMILTON, G. N., Power distributions and control worths in two-region clustered UO_2–D_2O lattice, 18: 26863 (CVNA-134)
HAMMER, C. L., Coulomb scattering of Dirac particles, 18: 26279
HAMMER, C. L., Method of asymptotic expansion of Fourier-type integrals, 18: 26280
HAMMITT, F. G., Void fraction measurements in cavitating venturi, 18: 25663
HAMPY, R. E., Capacitor with an internal gas barrier, 18: 27000
HANCHER, C. W., Conversion of radioactive liquid wastes to solids, 18: 26978 (ORNL-TM-857)
HANCOCK, Norman V., Fallout Pu-239 and Zr-95 in lungs of deer, 18: 25693
HAND, Elli Smakula, Nuclear H–deuterium exchange in resorcinols, 18: 25453
HANSEN, Larry F., Density determining apparatus, 18: 25773
HANSON, L. A., Precipitation of Th from Th–Mg by liquid Li, 18: 25904
HARDBOTTLE, R., Recycle process in chemical engineering, 18: 25647
HARDER, D., Fast electron backscattering from 8 to 22 Mev, 18: 26216
HARDER, R. L., Gas flows through electric arcs: hot gas containment limits, 18: 26687 (ARL-64-49)
HARDY, Lyndon M., Analysis of 1.0- to 1.4-Bev π-ρ enhancement, 18: 26346
HARGREAVES, W. A., Stimulated emission from $CeF_3:Nd^{3+}$, 18: 26119
HARGROVE, C. K., Neutron spectrum of an Am^{241}–Be(α,n) source, 18: 26510
HARLOW, Francis H., Slip instability, 18: 25667
HARLOW, M. V., Jr., Elastic scattering of 17- to 21-Mev neutrons from C-12, 18: 26547 (ORNL-3582(p.93-4))
HARMAN, B. N., Nucleate boiling heat transfer for pure liquid N and O, 18: 26462
HARMSEN, D. M., Interactions of 1.5 Bev/c K^- mesons with nuclei, 18: 26636
HARPER, A. Murray, Regional blood flow through the skin, 18: 25070
HARRIS, H. B., Gamma irradiation of Rhodesian sudan grass, 18: 25131
HARRIS, L. A., Properties of lanthanide germano-molybdates, 18: 25317 (CONF-405-31)
HARRIS, M. J., Reactor physics research at Victoria University, 18: 26828
HART, Edwin J., Conference on mechanisms in radiation chemistry of aqueous media, Gatlinburg, 5/63, 18: 25575
HART, Edwin J., Radiation chemistry of single-C compounds and reactions of hydrated electron, 18: 25579
HART, F. A., Complexes of 1,10-phenanthroline with lanthanide chlorides and thiocyanates, 18: 25387
HART, H. E., Recent developments in multicompartment tracer analysis, 18: 25052
HART, R. K., Corrosion research, 18: 25920 (ANL-6868(p.338-54))
HARTH, E., Lifetime of $_{\Lambda}H^3$, 18: 26527 (BNL-837(p.454-6))
HARVEY, J. A., Gamma spectra from neutron capture in isotopes of Sn, 18: 26540 (ORNL-3582(p.62-7))
HARVEY, J. A., Nuclear radii of isotopes of Sn, 18: 26538 (ORNL-3582 (p.56-7))
HARVEY, J. A., Parameters of low-energy resonances in W, 18: 26539 (ORNL-3582(p.58-60))
HARVEY, J. S., High-pressure high-temperature metallurgy, 18: 25972 (ASD-TDR-63-90(Vol.II))
HARVEY, M., Negative parity states in F-19, 18: 26592
HASEGAWA, Masayoshi, Uranium addition to low-C steels. I., 18: 26044

HASHIMOTO, Yoshio, Excited states in P-29, 18: 26593
HASHIZUME, Yoshio, Radiation-induced copolymerization of vinyl-type compounds, 18: 25535 (AEC-tr-6372(p.603-12))
HASSAN, H. A., Stress tensor of partially ionized gas, 18: 26734
HASTED, J. B., Electron capture by multiply charged ions, 18: 26229
HASTIE, R. J., Maximum plasma pressure for containment, 18: 26760
HASTY, Robert Armistead, II, Peroxides of Th, 18: 25440
HATADA, Motoyoshi, Radiation-induced reaction between acetaldehyde and ethylene, 18: 25509 (AEC-tr-6372(p.397-404))
HATADA, Motoyoshi, Radiation-induced telomerization of cyclohexene and acetaldehyde, 18: 25510 (AEC-tr-6372(p.405-12))
HATADA, Motoyoshi, Synthesis of tertiary amyl alcohol, 18: 25511 (AEC-tr-6372(p.413-19))
HATAKEYAMA, Noriyuki, Radiation-induced graft polymerization on cellulose. VI., 18: 25474 (AEC-tr-6372(p.83-8))
HATAKEYAMA, Noriyuki, Radiation-induced graft polymerization on cellulose. VIII., 18: 25476 (AEC-tr-6372(p.97-102))
HATAKEYAMA, Noriyuki, Radiation-induced graft polymerization on cellulose. XII., 18: 25480 (AEC-tr-6372(p.125-7))
HATT, B. A., Mechanical properties of quenched U–Mo alloys. II., 18: 26027
HATTA, Yoshisuke, Effects of close collisions on ion oscillations in plasma, 18: 26737
HAUBACH, Walter J., Comparative properties of He-3 and He-4, 18: 25325 (MLM-1161)
HAUSER, R., Industrial sintering of UO_2, 18: 25900
HAWK, Leroy R., Fluid metering device, 18: 26998
HAYASHI, H., Radiation injury in tissue culture, 18: 25117
HAYASHI, Koichiro, Crystal structure of radiation-induced polymers, 18: 25501 (AEC-tr-6372(p.311-21))
HAYASHI, Koichiro, Epitaxy associated with radiation-induced solid-state polymerization, 18: 25502 (AEC-tr-6372(p.323-30))
HAYASHI, Koichiro, Postirradiation polymerization of trioxane, 18: 25500 (AEC-tr-6372(p.299-310))
HAYASHI, Koichiro, Radiation-induced polymerization of phosphonitrile chloride, 18: 25496 (AEC-tr-6372(p.261-72))
HAYASHI, Koichiro, Radiation-induced polymerization of vinylene type monomers, 18: 25491 (AEC-tr-6372(p.207-12))
HAYASHI, Koichiro, Radiation-induced polymerization of formaldehyde. III., 18: 25492 (AEC-tr-6372(p.213-22))
HAYASHI, Koichiro, Radiation-induced polymerization of ketene types. I., 18: 25493 (AEC-tr-6372(p.223-35))
HAYASHI, Koichiro, Radiation-induced polymerization of ketene types. II., 18: 25494 (AEC-tr-6372(p.237-46))
HAYASHI, Koichiro, Radiation-induced polymerization of oxetane derivatives, 18: 25497 (AEC-tr-6372(p.273-86))
HAYASHI, Koichiro, Radiation-induced thermoluminescence of β-propiolactone, 18: 25498 (AEC-tr-6372(p.287-90))
HAYASHI, Koichiro, Radiation-induced polymerization by ring cleavage, 18: 25503 (AEC-tr-6372(p.331-47))
HAYASHI, Koichiro, Radiation-induced chlorination reactions of polyvinyl chloride, 18: 25504 (AEC-tr-6372(p.349-61))
HAYASHI, Koichiro, Solid-state polymerization of *N*-carboxy acid anhydrides, 18: 25495 (AEC-tr-6372(p.247-59))
HAYASHI, Koichiro, Uv-induced solid-state polymerization of β-propiolactone, 18: 25499 (AEC-tr-6372(p.291-7))
HAYMAN, P. J., Ionization loss of muons in plastic scintillator, 18: 25842
HAYS, J. B., Protecting communications systems from EMP, 18: 26819
HEARNE, J. A., Radiolytic oxidation of methane. I., 18: 25465 (AERE-R-4581)
HEATH, R. L., Light probe digital interrogator for analyzer oscilloscope displays, 18: 25825 (NAS-NRC-Pub-1184(p.313-19))
HEATON, J. W., Critical currents of a superconductor, 18: 26472
HEBBARD, D. F., States in N-14 near the proton threshold, 18: 26605
HECKER, H. C., Power distributions and control worths in two-region clustered UO_2–D_2O lattice, 18: 26863 (CVNA-134)
HECKMAN, Richard C., Cerium and Gd H systems, 18: 25363
HEDDLE, D. W. O., Excitation of the 2p state of H, 18: 26225
HEDGECOCK, Jackson L., Nuclear reactor fuel handling system, 18: 26860
HEDRICK, C. E., Separation of Mo in steels, 18: 25280
HEGENBARTH, J. J., Structures of Gd_2Al_3, Dy_2Al_3, Gd_2Ge_3, Dy_2Ge_3, and $DyAl_2$, 18: 25989
HEHEMANN, R. F., Homogenization kinetics of sintered Nb alloy, 18: 26047
HEIDT, H. M., Production of U metal powder, 18: 25916
HEIKKILA, W. J., Electrons in disturbed ionospheric E-region, 18: 26455
HEIMBUCH, Alvin H., Scintillating anion exchange resin, 18: 25259 (NYO-10405)
HEINEN, Harold J., Electrodeposition of Mo from molten electrolytes, 18: 25316 (BM-RI-6444)
HEINER, R. E., Mutation rate in barley, 18: 25182
HEISLER, L. H., Occurrence of sporadic-E, 18: 26440
HELLER, Adam, Organic liquid scintillators. VI., 18: 25559
HELLMAN, O., Possible generalization of quantum electrodynamics, 18: 26409
HELLMAN, Samuel, Sequelae of radical radiotherapy of lung carcinoma, 18: 25252
HELLMAN, W. S., Canonical property and asymptotic reduction procedures, 18: 26313
HENDERSON, C. M., Prog. rpt. on high-temperature thermoelectric research, 12/31/63–4/3/64, 18: 26251 (AD-437280)
HENDERSON, D. J., X-ray instrument utilizing radioisotope sources, 18: 25275
HENDRY, Archibald W., S-matrix poles close to threshold, 18: 26330
HENDRY, James Craig, Detection of the escape of fission products, 18: 25856
HENNAUT, J., Corrosion of C and stainless steels in water and steam. I., 18: 25922 (EURAEC-1038)
HENNE, Mary Tashdjian, Polarography of H_2O_2 in La solutions, 18: 25443
HENNIG, G. R., Lattice vacancies in graphite, 18: 26016
HENNING, N., Autologous bone marrow cell transfusion, 18: 25220
HENOC, Jean, Electron probe microanalyzer: fluorescence excited by continuous radiation, 18: 26105 (CEA-R-2421)
HENRY, Carl L., Care and maintenance of nuclear instruments, 18: 25862
HEPLER, L. G., Free energy of transfer of electrolytes from H_2O to D_2O, 18: 25338
HEPP, Klaus, Lorentz-invariant analytic S-matrix amplitudes, 18: 26294
HERB, R. G., Orbitron ionization gage, 18: 25757
HERMAN, J. R., Determining D-region electron-density profiles, 18: 26452
HERTZ, H. G., Chemical shifting of Li-7, Na-23, and Rb-87 resonances, 18: 25425
HESPEL, Claude, Mounting device for fuel element assemblies, 18: 26961
HESS, A., Semiconductor particle detectors. II., 18: 25837
HESS, D. C., Cosmic-ray ages of meteorites, 18: 26189
HESS, D. C., Radiation ages of some Fe meteorites, 18: 26198
HESS, Richard I., Analysis of 1.0- to 1.4-Bev π-p enhancement, 18: 26346
HESSON, G. M., Boiling burnout with fog-cooled 19-rod bundle, 18: 26900 (HW-80523(Rev.1))
HEUER, W., L/K capture ratio of Cr-51, 18: 26665
HIGSON, D. J., Nuclear propulsion for naval vessels, 18: 26960
HILDENBRAND, D. L., Thermodynamic properties of Li and Mg halides, 18: 25360
HILEY, P. C., Dose-effect measurements following tritiated thymidine administration, 18: 25069
HILL, Ronald Ames, Spectra of planar asymmetric molecules, 18: 25437
HILLS, H. K., Earth's outer radiation zone, 18: 26444
HILLS, R. F., Mechanical properties of quenched U–Mo alloys. I., 18: 26026
HINCHLIFFE, Zena, Determination of free I-131 in radioiodinated lipids, 18: 25296
HINMAN, George W., Angular correlation of γ rays from In-111 nuclei imbedded in Ag, 18: 26085
HINTENBERGER, H., Rare gases in stone meteorites, 18: 26197
HIROTA, Kozo, Graft polymerization following pre-irradiation in air by a $B^{10}(n,\alpha)Li^7$ reaction. III., 18: 25506 (AEC-tr-6372(p.371-7))
HIROTA, Kozo, Graft polymerization following pre-irradiation by $B^{10}(n,\alpha)Li^7$ reaction. II., 18: 25505 (AEC-tr-6372(p.363-9))
HIROTA, Kozo, Radiation-induced reaction between acetaldehyde and ethylene, 18: 25509 (AEC-tr-6372(p.397-404))
HIROTA, Kozo, Radiation-induced polymerization of vinyl acetate, 18: 25507 (AEC-tr-6372(p.379-85))
HIROTA, Kozo, Radiation-induced polymerization of ethylene, 18: 25508 (AEC-tr-6372(p.387-95))

HIROTA, Kozo, Radiation-induced telomerization of cyclohexene and acetaldehyde, 18: 25510 (AEC-tr-6372(p.405-12))
HIROTA, Kozo, Synthesis of tertiary amyl alcohol, 18: 25511 (AEC-tr-6372(p.413-19))
HIRSCHHORN, J. S., Cellular precipitation in Nb–Cr alloys, 18: 26022
HLAVATY, V., Using radioactive isotopes in women of childbearing age and pregnant women, 18: 25239
HOCH, M., Statistical model for nonsubstitutional solutions, 18: 25421
HOCH, Michael, System Ta–Ti–Zr–O at 1500°C, 18: 26053
HODGE, N., Gold as heat dispersant in exothermic solid-gas reactions, 18: 25420
HODGSON, Brian Purdon, Manufacture of neutron-absorbing materials, 18: 25958
HODGSON, P. E., Optical model and distorted wave analysis of (He^3,t) reactions, 18: 26596
HODGSON, R. T., Excitation of m = 0 instabilities in Z-pinch discharge, 18: 26733
HOEBEL, M., Distribution of I-131 in guinea pig trachea, 18: 25062
HOEGAASEN, J., Study of the Bardeen-Cooper-Schrieffer distribution, 18: 26491
HOEHLER, G., Analysis of the π^+ photoproduction, 18: 26282
HOEKSTRA, H., Structural studies on Li_2UO_3 and Na_2UO_3, 18: 25388
HOELD, A., Xenon and Ba diffusion on uncoated and coated ceramic fuel particles, 18: 25983 (SGAE-ME-1/1964)
HOELSCHER, H. E., Graphite oxidation at low temperat... 18: 25923
HOERNI, J. A., Effects of irradiation on field effect and injection transistors, 18: 25741 (N64-13153)
HOFF, G. T., Possible resonance at 829 Mev in ΛK^o production, 18: 26352
HOFFMAN, Joseph G., Prog. rpt. on tissue cell growth, final, 8/15/62–1/31/64, 18: 26982 (NYO-2462-1)
HOGG, B. G., Neutron separation energies for isotopes of Hg, Tl, Pb, and Bi, 18: 26576
HOHMUTH, K., Decay of Mo-93, 18: 26595
HOLDER, J., Preparation of sinterable UO_2 for EL4 fuel, 18: 25343
HOLLANDSWORTH, Clinton Edward, Jr., Scattering of fast neutrons from heavy weight nuclei, 18: 26671
HOLLOWAY, James H., Ion exchange procedures. II., 18: 25294
HOLLOWAY, James H., Ion exchange procedures. III., 18: 25295
HOLM, Hans I., Bibliography on determination of trace amounts of Cd, Cr, Co, Fe, Mn, and Mo in U, 18: 25272 (VDDIT-90)
HOLM, Lloyd Martin, Eigenfunctions of the electron spin operators, 18: 26211
HOLMES, J. M., Conversion of radioactive liquid wastes to solids, 18: 26978 (ORNL-TM-857)
HOLTEBEKK, Trygve, Double-focusing magnetic spectrometer for charged particles, 18: 25841
HOLWAY, Lowell H., Jr., Solutions to shock structure problem, 18: 26138
HOLZWARTH, G., Mott scattering of electrons by screened Au and Hg nuclei, 18: 26236
HONAKER, W. C., Radiation damage to transistors, 18: 26091
HOOKE, William M., Ion cyclotron resonance in plasmas, 18: 26739
HOOPER, F. R., Victoria and nuclear power, 18: 26929
HOPKINS, B. E., Structures of Nb–H systems, 18: 26024
HOPKINS, H. W. K., K_1^o regeneration in hydrogen, 18: 26264 (BNL-837 (p.82-7))
HOPKINS, H. W. K., Observation of reaction $\bar{p} + d \rightarrow \Lambda + \Sigma^- + \Xi^+$, 18: 26334
HOPWOOD, M. L., Effect of x irradiation of bovine testicles on semen, 18: 25185
HORIE, Kiyoko, Excited states in P-29, 18: 26593
HORNE, Thomas, Irradiation vault, 18: 25600
HORNIG, D. F., Spectrum and structure of H_2O and ionic solutions, 18: 25368
HORNSHOEJ, P., L-shell particle parameters in 42-kev E3 transition of Ir-191, 18: 26620
HOROWITZ, Robert M., Nuclear H–deuterium exchange in resorcinols, 18: 25453
HORROCKS, Donald L., Tritium produced in spontaneous fission of Cf-252, 18: 26644
HORTON, Clifford Charles, Improvements in reactors, 18: 26911
HORTON, Granville E., Application of radioisotopes to the study of cerebral blood flow, 18: 25043
HOSNY, Ahmed Nabil, Performance analysis of electrical propulsion systems, 18: 25635
HOUGHTON, G. K., Neutron thermalization in Zr hydride, 18: 26514
HOWARD, Christopher, Phenylbutazone and radiotherapy, 18: 25243
HOWELLS, H., Discharge of waste from Windscale, 18: 25723
HOWER, G. L., Effects of nuclear testing at medium frequencies, 18: 26454
HOWES, Patricia, Radiation hazards in the Ra wards, 18: 25719
HOWLETT, B. W., Mechanical properties of quenched U–Mo alloys. I., 18: 26026
HOY, Gilbert R., Angular correlation of γ rays from In-111 nuclei imbedded in Ag, 18: 26085
HSU, Yuin Chi, Counting efficiency of nuclear multiplate camera, 18: 25866
HSU, Yuin Chi, Neutron total cross section of Pr at 14 Mev, 18: 26577
HSU, Yung-lan, Area of movement of charged particle in dipole magnetic field, 18: 26117 (JPRS-23767(p.57-61))
HUANG, C. C., Irradiation-induced mutations in sorghum, 18: 25130
HUANG, Chia Yi, Counting efficiency of nuclear multiplate camera, 18: 25866
HUANG, Chia Yi, Neutron total cross section of Pr at 14 Mev, 18: 26577
HUANG, Wei-feng, Angular correlation in the $B^{11}(d,n\gamma)C^{13}_{3.68}$ reaction, 18: 26680
HUBBARD, Thomas P., Method of radioactivity tracer logging, 18: 25703
HUBNER, R. S., Neutron scattering from C, Be, Al, Fe, and polyethylene, 18: 26532 (NAA-SR-9418)
HUEPER, W. C., Occupational cancer, 18: 25211
HUET, M., Uranium refining techniques, 18: 25616
HUGHES, R., Permeability of neoprene and polyvinylchloride to H, D, and T, 18: 25706 (AWRE-O-17/62)
HUGHES, W. F., Interaction of transverse waves and a moving ionizing shock wave, 18: 26125
HULM, J. K., Flux jumping and degradation in superconducting solenoids, 18: 26463
HULSE, E. V., Biological effects of radiation on skin, 18: 25081 (AHSB(RP)R-39(p.21-9))
HULTHEN, L., Eigenfunctions for the deuteron ground state, 18: 26284
HUMMEL, Andries, Determination of ion pairs in irradiation of liquid, 18: 25555
HUMMEL, R. W., Radiolytic oxidation of methane. I., 18: 25465 (AERE-R-4581)
HUNDESHAGEN, H., Relative biological effectiveness of neutrons. IV., 18: 25107
HUNT, Stanley Ernest, Magnetic deflection system, 18: 26185
HURST, P. M., Properties of Zr and Hf peroxy compound, 18: 25379
HUSSAIN, M., Electron capture by multiply charged ions, 18: 26229
HUSTER, E., L/K capture ratio of Cr-51, 18: 26665
HUTCHEON, J. M., Improved graphite for nuclear reactors, 18: 26095
HUTCHINSON, R. I., Nucleation of grain-boundary cavities in Mg, 18: 26021
HUWE, Darrell O., Y†(1385 Mev): study of spin and parity, 18: 26340
HWANG, Jeun Lin, Counting efficiency of nuclear multiplate camera, 18: 25866
HWANG, Jeun-lin, Angular momentum distributions in Thomas-Fermi model, 18: 26578
HWANG, Jeun-lin, Force constants of the graphite lattice, 18: 25997

I

IACOBELLI-TURI, Carlo, Ion flotation of inorganic ions. I., 18: 25375
IBACH, Hanns, Constitution diagram for Ta–Rh, 18: 26048
IGNAT'EV, K. G., Interference effects in fission cross sections, 18: 26569
IGNAT'EVA, M. I., Radiation stability of alkali-halide crystals, 18: 25585
IIZUKA, Shinji, Radiation-induced reaction between acetaldehyde and ethylene, 18: 25509 (AEC-tr-6372(p.397-404))
IKEDA, Mineo, Bound states in full symmetry theory, 18: 26361
INGEBRETSEN, F., Analysis of γ-γ angular correlation measurements in aligned nuclei, 18: 26637
INNOCENTI, P. G., Design of 100-kG d-c magnet, 18: 26167 (CERN-64-23)
IOFFE, M. S., Experimental investigation of plasma instability in magnetic mirror trap, 18: 26695 (AEC-tr-5589(p.83-96))
IOFFE, Z. M., Effects of electron inertia of shock wave width in MHD, 18: 26149
IONESCU-PALLAS, N. Zh., Isotopic structure of the 5535 Å line of BaI, 18: 26213

IORI, I., Analysis of angular correlations of excitation functions, 18: 26634
IROKAWA, Hiroshi, Spectrophotometric determination of Nb in Ta, 18: 25284
ISABELLE, D. B., Excitation of levels of O-16 by electron scattering, 18: 26609
ISBELL, Horace S., Tritium-labeled compounds. XL, 18: 25459
ITO, Chuko, Preparation of anhydrous UF_4, 18: 25448
IVANOV, I. I., Decrease in DNA level of tissue after irradiation of organism, 18: 25137
IVANOV, L. I., Mechanism of creep of Zr, 18: 26002
IVANOV, V. A., Reversibility of β–ω transformation in Zr–16% Nb alloys, 18: 26003
IVANOV, V. E., Diffusion reaction in Mo–Si system, 18: 26001
IVANOV, V. E., High-temperature oxidation of Mo silicides, 18: 25928
IVANOVA, T. I., Gas discharge ion source, 18: 25655
IWASAKI, Ichiro, RF-type mouse leukemia induced by radiation, 18: 25226
IWASAKI, Matsu, Reaction of metallic W and F gas, 18: 25332 (UCRL-Trans-1044(L))
IZURA, Harumi, Beta dose measurements with compensated calorimeter, 18: 25829 (AEC-tr-6372(p.29-34))
IZURA, Harumi, Energy dissipation distribution of β rays in matter, 18: 26812 (AEC-tr-6372(p.11-15))
IZURA, Harumi, Measurement of β current density, 18: 25830 (AEC-tr-6372 (p.35-47))
IZURA, Harumi, Radiation-induced thermoluminescence of polyethylene, 18: 25471 (AEC-tr-6372(p.49-59))
IZURA, Harumi, Radiation-induced thermoluminescence of benzene derivatives, 18: 25472 (AEC-tr-6372(p.61-74))
IZURA, Harumi, Radiation-induced thermoluminescence of trioxane and dioxane, 18: 25473 (AEC-tr-6372(p.75-82))
IZURA, Harumi, Transmission of β rays through several materials, 18: 26813 (AEC-tr-6372(p.17-28))

J

JAATINEN, Walter A., High-energy plasma source, 18: 26811
JABBUR, Ramzi Jibrail, Bremsstrahlung spectrum, 18: 26380
JABOT, P., Production of U by electrorefining in molten salt baths, 18: 25399
JACCARINO, V., Anisotropic hfs interactions in ferromagnets, 18: 26038
JACOBS, A. J., Diffusion of O in W and some other transition metals, 18: 26035
JACOBS, J. F., Ferroelectric hysteresis bridge, 18: 25738 (BNL-8006)
JACQUESSON, Jacques, Determining proportion of simultaneously emitted neutrons, 18: 25857
JAINKE, L., Angular distributions and effective cross section of reaction $F^{19}(p,\alpha_0)O^{16}$, 18: 26664
JAIN, B. D., Precipitation of Ce(IV) and La, 18: 25351
JAIN, J. P., Optimum shape of shielding barrier for disc source, 18: 26818
JAKOBSON, M., Sensitivity of tobacco mosaic virus to fast electrons, 18: 25159
JANA, Manas K., X-ray-induced tall mutant of black gram, 18: 25133
JANCEL, R., Electrodynamics of plasmas. I., 18: 26793
JANDUSCHKIN, K. N., Electrochemical behavior of radioactive Fe and steel samples, 18: 25553
JANIK, F. A., Amplifier for particle accelerators, 18: 26184
JANIK, J. A., Cold neutron investigation of structure of liquids, 18: 26507
JANSEN, G., Jr., Thermal consequences of leaks in radioactive waste tanks, 18: 26976 (HW-80848)
JARMAN, D. M., Data listing program for U.K.A.E.A. Nuclear Data Library, 18: 25879 (AWRE-O-4/64)
JAROSCHEK, Kurt, Production of nuclear energy, 18: 26931
JASINSKA, J., Effect of x rays on incorporation of thymidine into Ehrlich's ascites tumor of mice, 18: 25173
JASINSKA, Janina, Radiation effects on incorporation of thymidine into Ehrlich carcinoma, 18: 25166
JASKOLA, M., Energy spectrum of α particles from $La^{139}(n,\alpha)Cs^{136}$ reaction at 14.1 Mev, 18: 26606
JASPERS, J. H., Argon arc welding method at Petten, 18: 25948
JAYARAMAN, S., Photovoltaic cell x-ray exposure rate meter, 18: 25867
JEDRUCH, J., Power distributions and control worths in two-region clustered UO_2–D_2O lattice, 18: 26863 (CVNA-134)
JELLIFFE, A. M., Biological effects of radiation on skin, 18: 25080 (AHSB(RP)R-39(p.11-19))
JENKINS, R. O., Activation of thoria-coated filament emitters, 18: 25752
JENKINS, T. R., Counter diffusion of gases in nuclear graphite, 18: 26061
JENKINSON, I. S., Radiation and biological membranes, 18: 25106
JEZOWSKA-TRZEBIATOWSKA, B., Change of Lande's interval parameter for U(IV), 18: 25339
JEZOWSKA-TRZEBIATOWSKA, B., Structure of uranyl nitrate in organic solvents. II., 18: 25394
JICHA, J. J., Pressure drop across thick-plate restrictions, 18: 25665
JOERGENSEN, Chr. Klixbuell, Reflection spectra of lanthanides in ThO_2, 18: 25423
JOHANSEN, Ivar, Radiation sensitivity of Drosophila embryos, 18: 25143
JOHANSONS, N., Eigenfunctions for the deuteron ground state, 18: 26284
JOHN, P. K., Charged particle escape in mirror magnetic field, 18: 26799
JOHNS, T. F., Measurement of skin doses from external radiation, 18: 25082 (AHSB(RP)R-39(p.31-43))
JOHNSON, C. H., Alpha-alpha correlations in $Li^7 + d \rightarrow 2\alpha + n$, 18: 26548 (ORNL-3582(p.99))
JOHNSON, C. H., Scattering of 3- to 4-Mev neutrons from O-16, 18: 26546 (ORNL-3582(p.90-2))
JOHNSON, J. W., Nanosecond pulsing for Van de Graaff accelerators, 18: 26176
JOHNSON, Philip C., Jr., Application of radioisotopes to the study of cerebral blood flow, 18: 25043
JOHNSON, R. A., Free radical addition reactions initiated by high-energy radiation, 18: 25466 (AERE-R-4587)
JOHNSON, R. M., Pathology report on experimental beagles, 18: 25093 (UCD-472-109(p.62-172))
JOHNSON, R. M., Status of experimental [beagle] colony, 18: 25089 (UCD-472-109(p.18-44))
JONES, C. M., Alpha-alpha correlations in $Li^7 + d \rightarrow 2\alpha + n$, 18: 26548 (ORNL-3582(p.99))
JONES, C. M., Proton bombardment of Li-6, Li-7, Be-9, B-11, and O-18, 18: 26601
JONES, K. M., Kinetic anisotropy in oxidation of graphite, 18: 25932
JONES, Leroy V., Preparation of Pu-bearing oxide particulates, 18: 26008
JONES, R., Two-body effective mass spectra in $\gamma + p \rightarrow p + \pi^+ + \pi^-$, 18: 26353
JOOS, H., Photoproduction of ρ and ω mesons in peripheral model, 18: 26373
JORDAN, T. F., Quantum theory of interference of light from two lasers, 18: 26425
JORTNER, Joshua, Conjecture on electron binding in aqueous solutions, 18: 25577
JOVANOVIC, J. V., Lifetime of K_1^0 mesons, 18: 26261 (BNL-837(p.42-52))
JU, F., Thermodynamic properties of Li and Mg halides, 18: 25360
JUDISH, J., Nanosecond pulsing for Van de Graaff accelerators, 18: 26176
JUENKE, E. F., Crystallographic data on UO_2WO_4 and UO_2MoO_4, 18: 26118
JURASKOVA, V., Effects of irradiation on growth of metastases, 18: 25162

K

KACZMAREK, Eugenia, Problems of magnetogasdynamics. I., 18: 26807
KADOMTSEV, B. B., Turbulent discharge in longitudinal magnetic field, 18: 26696 (AEC-tr-5589(p.438-62))
KAGAN, Morton R., Spectra and quantum states of Eu β-diketone chelates, 18: 25462
KAHAN, Henrick, Apparatus for the preparation of pure metals, 18: 25912
KAHAN, Th., Electrodynamics of plasmas. I., 18: 26793
KAHN, David, Longitudinal wave propagation in fully ionized gas, 18: 26757
KAIFER, R. C., Pulse multiplier using logarithmic diodes, 18: 25801 (NAS-NRC-Pub-1184(p.140-2))
KAINDL, K., Early damage in cells after ionizing radiation. II., 18: 25085 (SGAE-BL-5/1964)
KAIPOV, R. L., Actinium–Be sources for industrial geophysical investigations, 18: 25873
KAJI, I., Plasma waves with small amplitude, 18: 26729

KAJI, Ikuo, Nonlinear stationary plasma waves, 18: 26736
KALABA, Robert, Invariant imbedding theory of neutron transport, 18: 26508
KALBFLEISCH, George R., Analysis of 1.0- to 1.4-Bev π-p enhancement, 18: 26346
KALININA, M. D., Effect of Co-60 γ radiation on alkaline anion-exchange resins, 18: 25541
KALMAN, G., Dyson equation technique, 18: 26753
KALMAN, G., Statistical plasma theory. II., 18: 26686 (ARL-64-44(Pt.II))
KALVENES, O., Radiochemical study on Fe corrosion, 18: 25926
KAMADA, Wase, Radiation-induced polymerization by ring cleavage, 18: 25503 (AEC-tr-6372(p.331-47))
KAMENICEK, O., Influence of x irradiation on gastric transit time in rat, 18: 25172
KAMENSKAYA, D. S., Strength and decomposition of solid solutions of WC–Co, 18: 26004
KAMINSKII, A. K., Thick-walled ion chamber for monitoring γ radiation, 18: 25847
KAMMER, P. A., Cracking in high-strength steel weldments, 18: 25941 (DMIC-197)
KAN, Hsai-hsin, Principle of gas centrifugal separation and applications in isotopic separation, 18: 25878 (JPRS-23767(p.7-28))
KANDIAH, K., Display system for multiparameter experiments, 18: 25826 (NAS-NRC-Pub-1184(p.322-3))
KANDIAH, K., Event timing, 18: 25796 (NAS-NRC-Pub-1184(p.117-18))
KANDIAH, K., Linear gate and biased amplifier, 18: 25797 (NAS-NRC-Pub-1184(p.119-20))
KANDIAH, K., Low-noise pulse amplifiers, 18: 25790 (NAS-NRC-Pub-1184 (p.65-9))
KANDIAH, K., Magnetic tape systems at Harwell, 18: 25747 (NAS-NRC-Pub-1184(p.296-304))
KANDIAH, K., Performance of analog-to-digital converter, 18: 25808 (NAS-NRC-Pub-1184(p.177-9))
KANDIAH, K., Use of storage tubes as temporary stores for pulse amplitudes, 18: 25746 (NAS-NRC-Pub-1184(p.292-5))
KANDIAH, K., Use of avalanche diodes to produce random pulses, 18: 25815 (NAS-NRC-Pub-1184(p.212-15))
KANDIAH, Kathirkamathamby, Improvements in pulse amplitude discriminators, 18: 25767
KANE, J. V., Excited states of He-4, 18: 26528 (BNL-7983)
KANE, J. V., Nuclear radiation recorder analyzer, 18: 25821 (NAS-NRC-Pub-1184(p.255-65))
KANEVSKII, E. A., Reduction of uranyl carbonate complexes, 18: 25428
KANG, Kyungsik, Theory of low-energy π-σ scattering, 18: 26333
KANICHEVA, I. R., Distribution of electron beam energy losses, 18: 26822
KANICHEVA, I. R., Electrons transmitted by unsupported metal films, 18: 26821
KANTOROVICH, A., Triple product of septets in G_2 symmetry model, 18: 26316
KAPCHIGASHEV, S. P., Capture cross section of Cr, Cr-50, Cr-52, and Cr-53 for neutrons up to 50 kev, 18: 26570
KAPLYANSKII, A. A., Low-temperature spectra of divalent Sm, 18: 25406
KARAMYAN, A. S., Determination of number of neutrons emitted by source, 18: 26503
KARASIK, V. R., Production of high magnetic fields, 18: 26474
KARAYIANIS, Nicholas, Relativistic three-particle emission, 18: 26384
KARLIN, R. A., Ultra high-speed analyzer-computer, 18: 25818 (NAS-NRC-Pub-1184(p.229-36))
KARLSSON, S. K. F., Velocity of secondary flow in Taylor's stability problem, 18: 26139
KAROLCZAK, S., Energy transfer in radiolysis of solid systems. I., 18: 25544
KARPOV, V. L., Chemical radiation installation, 18: 25601
KARTMAZOV, G. N., Beryllium and Cr whiskers, 18: 26009
KARTTUNEN, J. O., X-ray instrument utilizing radioisotope sources, 18: 25275
KASHIMA, Masaaki, Simultaneous kinetics study of ^{131}I-hippuran and ^{131}I-rose bengal by double isotope technique. II., 18: 25050
KASHIWABARA, Hisatsugu, Capture domains for stable radicals from polyethylene, 18: 25532 (AEC-tr-6372(p.577-86))
KASHIWABARA, Hisatsugu, ESR spectra and physical state of alkyl-type radicals from polyethylene, 18: 25533 (AEC-tr-6372(p.587-92))
KATCOFF, S., Products formed by 2.9-Bev proton irradiation of Ag, 18: 26648
KATO, Yusuke, Asymptotic limits of operators in fixed-source theory, 18: 26430
KATZ, H., Decontamination of Savannah River waste supernate, 18: 26974 (BNL-853)
KAUFMAN, D. F., Prismatic slip in zone-refined Be, 18: 26049
KAUL, Ronald Dean, Level crossings in Hg, 18: 26676
KAWAI, Yoko, Quantized free unstable particle field, 18: 26429
KAWAMURA, Hajime, Line-broadening due to ionized impurity scattering in Ge, 18: 26112 (NP-14017)
KAWANISHI, Yasuo, RF-type leukemia induced by radiation, 18: 25226
KAYSER, Joachim, Polarization of fluorescence of organic crystals by α radiation, 18: 25594
KEARNS, T. F., Metal working processes and equipment program, 18: 25952
KECHIN, V. V., Galvanomagnetic effects in graphite, 18: 26040
KEDROVA, N. S., Reactions of Be and Al chloride etherates, 18: 25431
KEHOE, Brandt, Pion production by K^+ mesons on protons, 18: 26381
KELLEY, John P., Leakage radiation through lead glass, 18: 25249
KELLY, Donald P., Comparative properties of He-3 and He-4, 18: 25325 (MLM-1161)
KELLY, F. M., Isotope shift in Ba, 18: 26575
KENNA, B. T., Technetium in nature, 18: 25705
KENNEDY, J. M., Digital stabilizing methods for multichannel analyzing systems, 18: 25804 (NAS-NRC-Pub-1184(p.150-64))
KEPPLER, E., Radioactive debris from HA nuclear explosions, 18: 26099
KERN, Werner, Radioisotopes in semiconductor technology, 18: 25846
KERNAGHAN, Roy Peter, Xanthine dehydrogenase in Drosophila, 18: 25208
KERNS, Q. A., Light flash generator for gain stabilization of photosensitive systems, 18: 25817 (NAS-NRC-Pub-1184(p.220-8))
KERNS, Quentin A., Tunnel-diode discriminator circuit, 18: 25774
KERREBROCK, Jack L., Electrode losses in MHD generators, 18: 26252 (BSD-TDR-64-35)
KERTAI, Pal, Leukopenia and leukocytosis in parabiotic and whole-body irradiated rabbits, 18: 25150
KERWIN, Larkin, Effect of vibration excitation of H_2^+, 18: 26207
KEZER, O. F., Differential thermal analysis of basic rare earth azides, 18: 25446
KHACHATRYAN, B. V., Radiation from cylindrical bunches, 18: 26788
KHASANOV, R. M., Nonequilibrium evaporation of Ta, 18: 26015
KHITROVA, V. I., Investigation of hexagonal W nitride, 18: 26042
KHODZHAEV, L. Sh., Equations for π-N scattering at low energies, 18: 26299
KIEFFER, Richard, Vanadium, Nb, and Ta metallurgy, 18: 25906
KIENBERGER, C. A., Determination of Sr-90 in drinking water, 18: 25267 (K-1521)
KIKKAWA, Keiji, Test of R-reflection invariance, 18: 26366
KIKUCHI, T., Capture rate for muons in He-4, 18: 26524 (BNL-837 (p.309-13))
KIKUCHI, T., Lifetime of $_{\Lambda}H^3$, 18: 26527 (BNL-837(p.454-6))
KILLICK, R. A., Determination of Hg in rocks, 18: 25307
KILPATRICK, John W., Sexually sterile males for control of *Aedes aegypti*, 18: 25047
KIM, C. C., Interactions of 31-Mev protons with He-4, 18: 26604
KIM, Chung-wook, Nuclear moments in β radiation, 18: 26679
KIM, H., Strength function of isotopes of Zr, 18: 26544 (ORNL-3582 (p.82-4))
KIM, H. J., Reactions $Mg(\alpha,a)Mg^{24}$ and $Mg^{24}(\alpha,\alpha')Mg^{24*}$, 18: 26550 (ORNL-3582(p.101-2))
KIM, J. M., Water and natural U lattices, 18: 26880
KIMELDORF, Donald J., Accommodation to stress induced by irradiation, 18: 25100
KIMURA, Fujiko, Radiation-induced graft polymerization on cellulose. VII., 18: 25475 (AEC-tr-6372(p.89-96))
KIMURA, Fujiko, Radiation-induced graft polymerization on cellulose. IX., 18: 25477 (AEC-tr-6372(p.103-8))
KIMURA, Fujiko, Radiation-induced graft polymerization on cellulose. X., 18: 25478 (AEC-tr-6372(p.109-15))
KIMURA, K., Classification of leukemias by sensitivity, 18: 25049
KIMURA, Kiichi, Beta dose measurements with compensated calorimeter,

18: 25829 (AEC-tr-6372(p.29-34))
KIMURA, Kiichi, Energy dissipation distribution of β rays in matter, 18: 26812 (AEC-tr-6372(p.11-15))
KIMURA, Kiichi, Measurement of β current density, 18: 25830 (AEC-tr-6372 (p.35-47))
KIMURA, Kiichi, Radiation-induced thermoluminescence of polyethylene, 18: 25471 (AEC-tr-6372(p.49-59))
KIMURA, Kiichi, Radiation-induced thermoluminescence of benzene derivatives, 18: 25472 (AEC-tr-6372(p.61-74))
KIMURA, Kiichi, Radiation-induced thermoluminescence of trioxane and dioxane, 18: 25473 (AEC-tr-6372(p.75-82))
KIMURA, Kiichi, Transmission of β rays through several materials, 18: 26813 (AEC-tr-6372(p.17-28))
KIMURA, Toshiei, Commutation relation for canonical energy density, 18: 26431
KINCHIN, G. H., Experiment and theory in reactor physics, 18: 26827
KING, E., Radiation damage in metastable beta Pu, 18: 26075
KING, Lowell A., Electric conductivity of fused $LiNO_3$–$NaNO_3$–KNO_3 eutectic, 18: 26020
KING, Lowell A., Measurement of fused salt conductivity. I., 18: 26018
KING, R. F., Nanosecond pulsing for Van de Graaff accelerators, 18: 26176
KINSEL, Tracy Stewart, Superconductor of the second kind, 18: 26495
KINSEY, B. B., Elastic scattering of 17- to 21-Mev neutrons from C-12, 18: 26547 (ORNL-3582(p.93-4))
KINSEY, K. F., Reduced energy spread of synchrocyclotron beams, 18: 26177
KIRIANENKO, Alexis, Electron probe microanalyzer: fluorescence excited by continuous radiation, 18: 26105 (CEA-R-2421)
KIRKPATRICK, E. S., Spectrum of Fe^{3+} in $SrTiO_3$, 18: 25409
KIROV, A. G., Charge development in spatially periodic magnetic field, 18: 26705 (AEC-tr-5589(p.758-66))
KIRPICHNIKOV, I. V., Interference effects in fission cross sections, 18: 26569
KIRRMANN, Jean-Michel, Inhibition of O consumption in chicken embryo, 18: 25124
KIRZ, Janos, Analysis of 1.0- to 1.4-Bev π-ρ enhancement, 18: 26346
KISELEV, S. V., Neutron diffraction study of perovskite-like substances, 18: 25418
KISHKIN, S. T., Internal friction in deformed Mo, 18: 26041
KISIELESKI, W. E., Dose-effect measurements following tritiated thymidine administration, 18: 25069
KISLYAKOV, A. G., Measurements of radiation from moon and sun, 18: 26192
KISZA, A., Properties of UCl_4 in LiCl–KCl, 18: 25340
KITA, Hideji, Quantized free unstable particle field, 18: 26429
KITAHARA, Kozuo, Behavior of unsaturated fatty acids in a γ-ray field, 18: 25591
KITO, M., Plasma waves with small amplitude, 18: 26729
KITO, Masafumi, Nonlinear stationary plasma waves, 18: 26736
KJELLMAN, J., Upper limits for anomalous interactions of muon neutrinos, 18: 26321
KLAUDY, P. A., Experiments relating to layout of superconducting transformers, 18: 26466
KLEIN, Ann S., ORNL master analytical manual indexes, 18: 25271 (TID-7015(Indexes)(Rev.1))
KLEIN, Max, Pair correlation function for a hard-sphere fluid, 18: 26132
KLEIN, Rubin, Dose-time-volume relationship in carcinoma, 18: 25250
KLEIN, Siegfried, Conversion into electricity of reactor energy, 18: 26254
KLIEFOTH, Werner, From atomic nucleus to nuclear power station, 18: 26943
KLIGERMAN, Morton M., Sequelae of radical radiotherapy of lung carcinoma, 18: 25252
KLINGENSMITH, Raymond Wallace, Elastic scattering of He-3 at 20 Mev, 18: 26681
KLOTZBUECHER, E., Reactor materials, 18: 26033
KLOZOVA, Eva, Production of anthocyanins in *Impatiens balsamina* L. blossoms after acute irradiation, 18: 25064
KNAUF, George M., Space medicine in manned space flight program, 18: 25045
KNIGHT, W. L., Trapping of Λ hyperons in nuclear matter, 18: 26623
KNISELEY, R. M., Clinical bone marrow scanning with radioisotopes, 18: 25238
KNISELEY, R. N., Premixed, fuel-rich, oxyacetylene flame, 18: 25278
KNOKE, F., Solution of energy-dependent Boltzmann equation, 18: 26500
KNOX, R. S., Atomic multipole interactions in rare-gas crystals, 18: 26223
KNUDSEN, C. N., Transport of fluids in porous media. II., 18: 26975 (HW-72335(Pt.2))
KO, Roy, Spectrographic determination of Ta in Pu, 18: 25279
KOBAYASHI, Yutaka, Prog. rpt. on biologically active amines, annual, 8/63–5/64, 18: 25086 (TID-20636)
KOBE, Donald H., Absence of zero sound in superfluid Fermi systems, 18: 26471
[KOBISK, E. H.], Target preparation program, 18: 25877 (ORNL-3400)
KOBSA, I. R., Reactor pressure vessel material surveillance, 18: 26925 (GEAP-4423)
KOBZENKO, G. F., Chromium–Mo phase diagram, 18: 25998
KOCH, B., Microwave investigations of gas-detonation plasmas, 18: 26765
KOCH, H. W., Cross sections for electron and nuclear research, 18: 26684
KOCH, H. W., Microwave investigations of gas-detonation plasmas, 18: 26765
KOCHIN, A. E., Efficiency of neutron sources by Au-foil activation method, 18: 26505
KOEHLER, W. C., Alignment of rare earth moments in dilute Pd–Fe alloys, 18: 25977 (ORNL-3582(p.2-4))
KOEHLER, W. C., Antiferromagnetism of ordered Pd_3Cr, 18: 25978 (ORNL-3582(p.5-6))
KOEHLER, W. C., Magnetic properties of intra-rare-earth alloys, 18: 25980 (ORNL-3582(p.9-10))
KOEHLER, W. C., Magnetic structure properties of rare-earth alloys, 18: 25981 (ORNL-3582(p.11-16))
KOEHLER, W. C., Neutron-diffraction investigation of Cr alloys, 18: 25979 (ORNL-3582(p.7-8))
KOENIG, H., Rare gases in stone meteorites, 18: 26197
KOERNER, Hanns-Joachim, Radiation protection in medical application of Ra, 18: 25734
KOETKE, D., Capture rate for muons in He-4, 18: 26524 (BNL-837 (p.309-13))
KOH, Yoon Suk, Variational treatment of hard-core interactions, 18: 26306
KOKKEDEE, J. J. J., Scattering of slow neutrons on crystals and fluids. II., 18: 26509
KOLESAR, D., Diagnosis of chronic radiation sickness, 18: 25153
KOLONTSOVA, E. V., Structure of pentaerythrite irradiated with x rays, 18: 26083
KOLOSHNIKOV, V. G., Measurement of ion temperature with "Tokomak" apparatus, 18: 26708 (AEC-tr-5589(p.861-8))
KOMANICHU, N., Isotopic structure of the 5535 Å line of Ba I, 18: 26213
KOMAR, Arthur, Commutators on characteristic surfaces, 18: 26420
KOMEL'KOV, V. S., Compression of plasma by rapidly increasing magnetic field, 18: 26698 (AEC-tr-5589(p.565-84))
KOMENDA, S., Influence of x irradiation on gastric transit time in rat, 18: 25172
KONDRATENKO, A. N., Theory of plasma wave guide in field, 18: 26784
KONDRAT'EV, I. G., Field structure within plasma layer of zero permeability, 18: 26726
KONDRAT'EV, I. G., Two-dimensional EM fields guided by plasma layers. I., 18: 26725
KONSTANTINOV, A. A., Measurement of efficiency of neutron sources, 18: 26504
KONZAK, C. F., Mutation rate in barley, 18: 25182
KOPPENAAL, T. J., Effect of neutron irradiation on alpha Cu–Al single crystals, 18: 26074
KOPYTIN, N. S., Scattering of 0.5- to 0.8-Mev neutrons, 18: 26571
KORKISCH, J., Ion exchange in non-aqueous solvents, 18: 25305
KORZH, I. A., Scattering of 0.5- and 0.8-Mev neutrons, 18: 26568
KORZH, I. A., Scattering of 0.5- to 0.8-Mev neutrons, 18: 26571
KOSANIC, M. M., Determination of CO_2, H_2, and O_2 in aqueous solutions, 18: 25273 (AEC-tr-6227/1(p.9-14))
KOSIEK, R., Effective cross section of photoprotons from N-14, 18: 26633
KOSKELIN, Martti, Decay of Si-28 levels, 18: 26661
KOSKY, P. G., Nucleate boiling heat transfer for pure liquid N and O, 18: 26462
KOSTIN, M. D., Generalizations of Fick's law, 18: 26518
KOTTLER, H., Analytic deuteron wave functions, 18: 26308

KOVAN, I. A., Propagation of EM waves in plasma along magnetic field, 18: 26699 (AEC-tr-5589(p.595-611))
KOVTUN, G. P., Vapor pressure over solid Be, 18: 26014
KOWALSKI, K. L., Analytic deuteron wave functions, 18: 26308
KOZMA, P., Effects of total-body irradiation. II., 18: 25140
KRAMER, Andrew W., Nuclear energy. XV., 18: 26572
KRAMER, G., Photoproduction of pions in forward direction and Regge poles, 18: 26372
KRAMER, G., Photoproduction of ρ and ω mesons in peripheral model, 18: 26373
KRANZ, Lothar, Gas-flow counter, 18: 25859
KRASNICKI, Sz., Spin fluctuation scattering of neutrons on pyrrhotite, 18: 26498 (PAN-280)
KRASOVITSKII, V. B., Passage of ion beams through plasma, 18: 26722
KRATKY, O., Absolute intensity of diffuse x-ray small-angle scattering, 18: 25838
KREIMER, G. S., Strength and decomposition of solid solutions of WC–Co, 18: 26004
KRELL, Max, Calculation method for optical model, 18: 26663
KREPS, Rodney Emerson, Regge poles in high-energy photomeson production, 18: 26385
KRESS, R. P., Determination of number of neutrons emitted by source, 18: 26503
KRIEGER, T. J., Statistical theory of nuclear reactions, 18: 26529 (BNL-8020)
KRIEGLER, Frank Joseph, Fields excited in accelerator cavities by charged particles, 18: 26181
KRISHNAMURTHY, M., Studies on EDTA complexes. II., 18: 25380
KRISHNA RAO, J., Type-N gravitational waves, 18: 26394
KROH, J., Energy transfer in radiolysis of solid systems. I., 18: 25544
KROH, J., Energy transfer in radiolysis of solid systems. II., 18: 25545
KROLL, Wolfgang, Van Alphan-de Haas effect for bound electrons, 18: 26393
KRONSBEIN, J., Electron microscope for determination of molecular structure, 18: 25749 (ORNL-3582(p.40-1))
KRUEGER, H., Relative biological effectiveness of neutrons. IV., 18: 25107
KRUGLIKOV, R. I., Higher nervous activity in animals prenatally exposed to ionizing radiation, 18: 25121
KRUGLOV, S. P., Energy measurement in bremsstrahlung beam, 18: 25861
KRUGLYKH, A. A., Vapor pressure over solid Be, 18: 26014
KSHNYAKINA, A. N., Neutron diffraction study of perovskite-like substances, 18: 25418
KUBO, Hiroshi, Microwave radiation at cyclotron harmonics in positive column, 18: 26691 (IPPJ-23)
KUCHARCZYK, Piotr, Problems of magnetogasdynamics. I., 18: 26807
KUEHNEL, Adolf, Equations of motion in theory of gravitational perturbations, 18: 26391
KUKHARENKO, N. K., Actinium–Be sources for industrial geophysical investigations, 18: 25873
KULESHOV, V. F., Charged-particle interactions with plasma, 18: 26781
KULIN, S. A., High-pressure high-temperature metallurgy, 18: 25972 (ASD-TDR-63-90(Vol.II))
KULYUPIN, Yu. A., Luminescence of KNO_3 irradiated with γ rays, 18: 25586
KUMAR, M. N., X-ray fluorescence Pb–U ratio measurements, 18: 25704
KUMAR, Sushil, Fast-neutron-induced leaf tumors in barley, 18: 25178
KUMPF, Hermann, Charging machine for gas or liquid cooled reactors, 18: 26854
KUMPF, Hermann, Electrohydraulic drive for nuclear reactors, 18: 26851
KUNTA, U. S., Radiation damage to methionine and its derivatives, 18: 25573
KUNIMASA, Tosaku, Anti-shrinkage of the p-$\bar{p}$ diffraction scattering, 18: 26365
KUNKEL, W. P., Out-of-pile temperature evaluation of fission product retention in Na, 18: 25326 (NAA-SR-Memo-9383)
KUPATT, H.-D., Diffusion theory of spin particles: relaxation constant for fast electrons, 18: 26371
KURI, Zenichiro, Gamma-induced liquid-phase polymerization of acrylamide, 18: 25536 (AEC-tr-6372(p.613-16))
KURI, Zenichiro, Radiation-induced polymerization in liquid SO_2, 18: 25537 (AEC-tr-6372(p.617-25))
KURITA, S., Classification of leukemias by sensitivity, 18: 25049
KURNAKOV, N. N., Properties of Nb–Mo–Cr alloys at high temperatures, 18: 26012
KURODA, P. K., Technetium in nature, 18: 25705
KURSANOV, Yu. V., Charge development in spatially periodic magnetic field, 18: 26705 (AEC-tr-5589(p.758-66))
KUTNETSOV, V. V., Motion of individual charged particles in trap, 18: 26702 (AEC-tr-5589(p.637-77))
KUZEEV, B. I., Determination of number of neutrons emitted by source, 18: 26503
KUZNETSOVA, T. I., Solutions of wave equations for heterogeneous layers, 18: 26434
KUZNETZOV, V. G., Lanthanum tellurides, 18: 25430
KUZOVNIKOV, A. A., Space potential plasma disturbed by heterogeneous h-f field, 18: 26776
KWIECINSKI, J., Pion-pion scattering amplitude, 18: 26326

L

LABAT, J., Azimuthal pinch discharges in H, 18: 26735
LADD, J. A., Digital stabilizing methods for multichannel and analyzing systems, 18: 25804 (NAS-NRC-Pub-1184(p.150-64))
LAFFERTY, Robert H., Jr., Production of Cs-47, 18: 25876 (ORNL-IIC-2)
LAGRANGE, E., Effect of x rays on metacercarcia of *Fasciola hepatica*, 18: 25128
LAIKHTMAN, B. D., Cross section of incoherent scattering of neutrons in a crystal, 18: 26520
LAJTHA, L. G., Continuous irradiation with tritiated H_2O of mammalian cells, 18: 25156
LAKEY, L. T., Waste calcining facility safety analysis, 18: 26977 (IDO-14620)
LAMBERT, P. V., Approximation of functions of two variables, 18: 25887
LAMBERT, R. B., Velocity of secondary flow in Taylor's stability problem, 18: 26139
LAMING, F. P., Complexes of 1,10-phenanthroline with lanthanide chlorides and thiocyanates, 18: 25387
LAMMERANT, J., Thoracic radioactivity of anesthetized dogs, 18: 25040
LANDINI, P., Failure and successive recovery of control rods, 18: 26923 (EUR-1810.i(Paper 6))
LANDIS, D., Linear amplifier, gating and timing system, 18: 25799 (NAS-NRC-Pub-1184(p.124-34))
LANDIS, D., Los-noise pre-amplifier for use with semiconductor detectors, 18: 25789 (NAS-NRC-Pub-1184(p.61-4))
LANDIS, D., Phototube noise rejection using pulse cross-over technique, 18: 25802 (NAS-NRC-Pub-1184(p.143-5))
LANG, G., Transistorized high-resolution time analyzer, 18: 25753
LANGENDORFF, H., Influence of x rays on pyridoxal phosphate in *E. coli*, 18: 25103
LANGHOFF, H., Resonance fluorescence in Re-187, 18: 26685
LANZ, Renato, Separation of P-32 from irradiated sulfates, 18: 25615
LAPP, Thomas W., Radiolysis of cyclohexane and cyclohexane-d_{12} with benzene and benzene-d_6, 18: 25566
LARANJEIRA, M. F., Equivalent atomic number of complex targets for saturation backscattering of electrons, 18: 26660
LARGE, Robert F., Polarographic behavior of Dy(III) in aqueous solutions, 18: 25333
LAROCHE, A., Production of U by electrorefining in molten salt baths, 18: 25399
LARSEN, Arlose, GRAPE—computer program for classical many-body problems in radiation damage, 18: 26070 (BNL-7979)
LARSEN, E. M., Properties of Zr and Hf peroxy compound, 18: 25379
LARSEN, R. N., "On-line" operation of a digital computer, 18: 25888
LARSEN, W. L., Crystallographic lattice type and cell constants, 18: 26108 (IS-839)
LARSON, A. H., Thermodynamic study of the Zr–S system, 18: 26065
LARSSON, Berje, Observations on pigeons with prethalamic radiolesions, 18: 25099
LARVIN, S. O., Determination of $_{94}\rho$ and δ-28 based on chemical separation of Np-239 and Mo-99, 18: 26249
LA SELVA, A., Irradiation of the heart with Co-60, 18: 25109
LAURENT, Camille, Fuel elements and expansion of civilian atom, 18: 26902

LAVAL, G., Marginal stability condition for stationary non-dissipative motions, 18: 26738
LAVAL, G., Movement of helical plasma segment, 18: 26741
LAVERGREN, B. T., Low-lying levels of Al-27. II., 18: 26613
LAWSON, A. W., Decontamination of skin, 18: 25213 (AHSB(RP)R-39 (p.69-77))
LAWSON, Donald Wilfred, Improvements in neutron shielding, 18: 26837
LAYTHER, K. R., Fuel element development for gas-cooled reactors, 18: 26905
LAX, Melvin, Quantum relaxation, lattice absorption and inelastic neutron scattering lines, 18: 26130
LAYLEE, A. M., Anatomy and physiology of skin, 18: 25038 (AHSB(RP)R-39(p.1-10))
LEA, James Dighton, Hartree-Fock-Slater scattering factors, 18: 26234
LEACH, L. J., Behavioral effects in pigeons exposed to Hg vapor, 18: 25057 (UR-645)
LEBER, S., Homogenization kinetics of sintered Nb alloy, 18: 26047
LEBOUTET, Hubert, Wave guide for electron linac, 18: 26183
LEBOWITZ, Joel L., Time symmetry in quantum process of measurement, 18: 26417
LEDERER, M., Chromatography on ion exchange papers. XII., 18: 25374
LE DOUARIN, Georges, Inhibition of O consumption in chicken embryo, 18: 25124
LEE, C. C., Disappearance of radicals trapped in γ-irradiated flour, 18: 25123
LEE, Kenneth, Properties of $CaMnF_3$, 18: 26159
LEE, Sook, ESR of irradiated alkali borate glasses, 18: 26079
LEE, Tsu-chien, Force constants of the graphite lattice, 18: 25997
LEE, W. W., X-ray fluorescence tables: LiF crystal, 18: 25330 (Y-1470-C)
LEE, W. W., X-ray fluorescence tables: EDDT crystal, 18: 25449 (Y-1470-D)
LEES, Joseph K., Angular correlation of γ rays from In-111 nuclei imbedded in Ag, 18: 26085
LEFEUVRE, Camille, Fuel element loading device for reactor, 18: 26843
LEFF, Harvey S., Characterization of nth-order energy-level spacing distributions, 18: 26587
LEFF, Harvey S., Statistical theory of energy-level spectra, 18: 26588
LEFILLATRE, Guy, Manufacture of products containing radioactive materials, 18: 26980
LEGAULT, R. A., Corrosion research, 18: 25920 (ANL-6868(p.338-54))
LEGRAND, Pierre, Improvements in multitubular heat exchanger, 18: 25672
LEHN, D., Power supply of electromagnets, 18: 25642
LEHNERT, Bo, Plasmas—laboratory scale, 18: 26764
LEHRNBECHER, W., Distribution of I-131 in guinea pig trachea, 18: 25062
LEIPOLD, M. H., Thermal expansion of Y oxide, 18: 25355
LEIPUNSKAYA, D. I., Actinium–Be sources for industrial geophysical investigations, 18: 25873
LEMBCKE, Kerin, Thorotrast tumors of the liver, 18: 25205
LEMBRA, Yu. Ya., Radial motion of particles in accelerator during beam extraction, 18: 26179
LEMPICKI, A., Europium chelates as laser materials, 18: 25445
LENDINARA, L., Lifetime of ${}_{\Lambda}H^{4}$, 18: 26527 (BNL-837(p.454-6))
LENG, J., Analog-to-digital converter, 18: 25809 (NAS-NRC-Pub-1184 (p.180-3))
LENG, J., Information processing equipment for physics at Chalk River, 18: 25742 (NAS-NRC-Pub-1184(p.23-35))
LENG, J., Time-shared computer for real-time information processing, 18: 25883 (NAS-NRC-Pub-1184(p.271-82))
LENZERINI, L., Effects of irradiation on the polysaccharide phosphorylase activity in the liver of rats, 18: 25115
LERNER, M. W., Dissolution and assay of elemental B, 18: 25276
LE ROY, C., Uranium production plant at Le Bouchet, 18: 25899
LESMONI, G., Failure and successive recovery of control rods, 18: 26923 (EUR-1810.i(Paper 6))
LESMONI, G., First "fast burst" occurring in Latina reactor, 18: 26922 (EUR-1810.i(Paper 5))
LETCHER, S. V., Magnetically induced sound absorption in liquid Na and K, 18: 26131
LETO, J. R., Luminescence of Eu hexafluoroacetylacetonate, 18: 25558
LEVAY, Bela, Determination of tritium in form of water and hydrocarbon, 18: 25301
LEVELL, R. W., Characteristics of mineral insulated cables for reactor control pulse counting channels, 18: 26830 (AEEW-M-369)
LEVI, C., Analysis of angular correlations of excitation functions, 18: 26634
LEVIN, M. L., Radiation of longitudinal waves in media with weak spatial dispersion, 18: 26727
LEVIN, M. L., Solution for quasistationary electrodynamics, 18: 26770
LEVIN, V. A., Ion beam neutralization, 18: 26148
LEVINE, E. D., Prismatic slip in zone-refined Be, 18: 26049
LEVITIN, R. Z., Young's modulus anomalies in rare earth ferromagnets, 18: 26006
LEWIS, W. B., Exploiting the U–Th fission cycle, 18: 26917 (DM-72)
LI, C. H., Transition in microstrain characteristics of Be, 18: 25991
LIEB, K. P., Excited state at 25 Mev in Be-8, 18: 26617
LIESER, K. H., Radiochemical study on Fe corrosion, 18: 25926
LIESER, K. H., Radiochemical study on Zn corrosion, 18: 25927
LIGHTER, R. G., Pressure drop across thick-plate restrictions, 18: 25665
LIJBRINK, Ir. E., Argon arc welding method at Petten, 18: 25948
LIKHTER, A. I., Galvanomagnetic effects in graphite, 18: 26040
LILEEV, I. S., Preparation of La silicates, 18: 25433
LIMONCELLI, E. A., Instrumentation for determining Ar and He purity, 18: 25264 (CNLM-4016)
LIN, J., Helium-3-induced charged-particle reactions, 18: 26549 (ORNL-3582(p.100-1))
LIN, S. H., Hydrodynamic entrance region of tubes and ducts, 18: 25668
LINCOLN, J. Virginia, Geomagnetic and solar data, 18: 26453
LINDA, Yerbo, Gas chromatography with ionization detector, 18: 25770
LINDELL, Bo, Iron-59 absorption measurements by whole-body counting and fecal recovery, 18: 25072
LINDELL, S. E., Recording rapid changes in radiation intensity, 18: 25051
LINDHOLM, E., Dissociation of acetylene molecule ions, 18: 25336
LINDSAY, J. B., Fast pulse-height analyzer, 18: 25810 (NAS-NRC-Pub-1184(p.184-5))
LINEVSKY, M. J., Electronic band spectrum of Y monofluoride, 18: 26163
LINGENFELTER, R. E., Neutron leakage from interactions of solar protons in the atmosphere, 18: 26446
LINIECKI, J., Metabolism of Sr in adult humans, 18: 25073
LINNENBOM, V. J., Radiation effects on insulation, 18: 26077
LINNETT, J. W., Effect of D on photo-oxidation of CH_3I, 18: 25587
LIPMAN, P. W., Geological map of the Topopah Spring SW Quadrangle, Nevada, 18: 26986 (TEI-846)
LIPMANOV, E. M., One lepton charge or two lepton charges?, 18: 26309
LIPNIK, P., Matrix elements of first-forbidden β transitions. I., 18: 26607
LISOV, G. N., Chemical radiation installation, 18: 25601
LIVINGSTON, M. Stanley, High-energy electron accelerators, 18: 26168 (CONF-401-2)
LLOYD, Ray D., Fallout Pu-239 and Zr-95 in lungs of deer, 18: 25693
LOBKOWICZ, F., Reduced energy spread of synchrocyclotron beams, 18: 26177
LOCKER, A., Action of radiation protection through olive oil, 18: 25231
LOCKHART, L. B., Jr., Characteristics of air filter media used for monitoring airborne radioactivity, 18: 26098 (NRL-6054)
LOCKNEY, Eric Victor, Compensation of Wigner growth in nuclear reactors, 18: 26841
LOEBBAKA, D. S., Lifetime of K_2^+ mesons, 18: 26261 (BNL-837(p.42-52))
LOESCH, P. J., Jr., Breeding value of x-ray induced macromutant. I., 18: 25132
LOEWENSTEIN, Paul, Metallurgical bonding of dissimilar metals by co-extrusion, 18: 25953
LOFFTUS, Fred H., Sintered beryllia and beatonite product, 18: 25965
LOMAKIN, S. S., Critical assemblies with Be moderator, 18: 26248
LOMBARD, R. J., Internal conversion in Tl-203, 18: 26630
LOMBARD, Roland, Effects of nuclear structure on formation of internal pairs, 18: 26581
LONGWORTH, G., Elastic nuclear resonant scattering of Fe-57 γ rays, 18: 26657
LONGWORTH, G., Nuclear resonant scattering in single crystals, 18: 26656
LONSKII, E. S., Thick-walled ion chamber for monitoring γ radiation, 18: 25847
LOPATIN, I. V., Energy measurement in bremsstrahlung beam, 18: 25861
LOPEZ, C. A., Analyticity of the Jost functions, 18: 26311
LORQUET, A. J., Radiolysis of propylamine, 18: 25552
LORRAIN, Ch., Process for treatment of uranothorianite, 18: 25617

LOVE, T. A., Neutron time-of-flight zero-cross-over pulse shape discriminator, 18: 25803 (NAS-NRC-Pub-1184(p.146-9))
LOVITCH, L., Charge dependence of nuclear forces and isobaric triplet A = 14, 18: 26618
LOWDER, Wayne M., Dose rates from γ radiation in US, 1962–63, 18: 25694
LOWES, Leonard, Liquid-liquid contacting apparatus, 18: 25628
LOWRY, B. A., Perturbation calculation of mixed-pair correlation functions, 18: 26133
LOWRY, R. A., Total ionization in Ar by heavy ions, 18: 26217
LOZOVSKII, S. N., Plasma interactions with h-f field, 18: 26775
LUBELL, M. S., Flux jumping in superconducting solenoids of Nb–Zr and Nb–Ti, 18: 26470
LUDBROOK, Leslie Carter, Improvements in frequency convertors, 18: 25637
LUGOVOI, V. N., Fluctuations in periodically nonstationary systems, 18: 26724
LUKIRSKII, A. P., Photoionization absorption cross section of Be, 18: 26215
LUNDE, J. E., Void reactivity effects in second charge of Halden BWR, 18: 26947
LUNDGREN, T. S., Hydrodynamic entrance region of tubes and ducts, 18: 25668
LUR'E, K. A., Optimum control of fluid moving along channel, 18: 26140
LUSIGNAN, Bruce Burr, Detection of solar particle streams, 18: 26247
LUTZ, H. R., MINOR—subcritical facility for heavy-water lattice studies, 18: 26882
LUZZATTI, G., Irradiation of the heart with Co-60, 18: 25109
LYDY, David Lee, Radiochlorine exchange on oxychloride systems, 18: 25441
LYON, D. N., Nucleate boiling heat transfer for pure liquid N and O, 18: 26462

M

MA, Benjamin Minglı, Instability of cylindrical fuel elements, 18: 26906
MACDOUGALL, J. D., Neutron separation energies for isotopes of Hg, Tl, Pb, and Bi, 18: 26576
MACFARLANE, R. D., Theoretical calculations of properties of rare-earth α emitters, 18: 26640
MACFARLANE, Ronald D., Alpha decay of Tb and Dy isotopes, 18: 26615
MACHNIG, O., Reactor materials, 18: 26034
MACK, D. A., Direct 3-D display, 18: 25748 (NAS-NRC-Pub-1184(p.320-1))
MACK, J. E., Behavior of He II 3s, p, d-4s, p, d, f line complex plasma, 18: 26219
MAC KENZIE, D. R., Extraction of Pu by hexone from aqueous solutions, 18: 25604 (CRC-487)
MACKLIN, R. L., High-resolution neutron total cross sections, 18: 26543 (ORNL-3582(p.75-82))
MACRAE, William, Improvements in nuclear reactors, 18: 26839
MADELL, John T., Isotope production as by product in fast power reactors, 18: 26927 (TID-20647)
MAEDER, D., Development of "nanoboxes", 18: 25827 (NAS-NRC-Pub-1184(p.325-30))
MAEKAWA, Takeyoshi, Bound states in full symmetry theory, 18: 26361
MAGDON, E., Radiosensitivity of *Vicia faba* primary roots, 18: 25183
MAGGIO, Ralph C., Detection of radiations of different energies, 18: 25853
MAGLIC, R., Spin fluctuation scattering of neutrons on pyrrhotite, 18: 26498 (PAN-280)
MAGLIULO, V., Cytochemical findings in the liver after irradiation, 18: 25141
MAGRANE, W. G., Ophthalmoscopic findings in experimental dogs, 18: 25090 (UCD-472-109(p.45-8))
MAH, George, Diffusion of O and N between interstitial sites in Yb, 18: 26050
MAHAFFEY, D. W., Shock waves in electrically driven shock tube, 18: 25645
MAHAJAN, K. K., Loss and drift terms in the ionospheric F region, 18: 26443
MAHAN, Bruce H., Gaseous ion recombination rates. II., 18: 26210
MAHMOUD, K. A., Penetration of γ rays in paraffin, 18: 26820
MAIENTHAL, E. Jane, Determination of Zr in ZrO_2–$YO_{1.5}$, 18: 25277
MAIER, K., Effective cross section of photoprotons from N-14, 18: 26633
MAILLET, Emmanuel, Tubular heat exchanger element with fins, 18: 26913
MAISIN, H., Radiation effects on radioresistance, 18: 25127
MAKI, Ziro, Fourth baryon, Sakata Model and Modified B-L symmetry. I., 18: 26367
MAKI, Ziro, Fourth baryon, Sakata Model and Modified B-L symmetry. II., 18: 26368
MALAKHOVSKII, A. I., Radiometric action of antitumor agents of chlorethylamine group, 18: 25154
MALDAGUE, Pierre E., Prospects for the Vulcain reactor, 18: 26969
MALINOWSKI, Zbigniew, Complications in treatment of urinary bladder cancer, 18: 25244
MALLICK, G. T., Flux jumping in superconducting solenoids of Nb–Zr and Nb–Ti, 18: 26470
MALM, J. G., Hydrolysis of XeF_4 and aqueous solution chemistry of Xe, 18: 25357
MALM, John G., Characterization of divalent Xe in aqueous solution, 18: 25358
MANDEL'SHTAM, S. L., Measurement of ion temperature with "Tokomak" apparatus, 18: 26708 (AEC-tr-5589(p.861-8))
MANDRIN, C., Physics of neutron-active zones, 18: 26879
MANEELY, D. J., Expansion of low-quality two-phase fluid, 18: 25662
MANFREDI, P. F., Causes of inaccuracy in analog-to-digital conversion, 18: 25811 (NAS-NRC-Pub-1184(p.186-94))
MANG, H. J., Binding energies of light hyperfragments, 18: 26591
MANN, D. E., Electronic band spectrum of Y monofluoride, 18: 26163
MANN, E. R., Improved servo-controlled regulator for reactors, 18: 26856
MANN, Horace T., Deposition of thin films by electron bombardment, 18: 26496
MANSFIELD, W. K., Water and natural U lattices, 18: 26880
MANTEGA, F., Autoclave with forced circulation, 18: 25639 (CISE-99)
MANZINI, R., Build up factors of J. J. Taylor equation, 18: 26814 (ORNL-tr-80)
MAPLETON, R. A., Asymptotic form of the electron capture cross section, 18: 26227
MARATECK, S., Beta decay of Σ^+ and Σ^- hyperons, 18: 26354
MARCUS, Bruce David, Saturated nucleate pool boiling heat transfer, 18: 25671
MARCUS, Y., Praseodymium(IV) nitrate, 18: 25353
MARICHEV, V. A., Internal friction in deformed Mo, 18: 26041
MARIKYAN, G. A., Fluctuation and ionization in low-pressure detectors, 18: 25831
MARINI, G., Two-body effective mass spectra in $\gamma + p \rightarrow p + \pi^+ + \pi^-$, 18: 26353
MARINKOVIC, M. D., Broadening and shift of A(III) spectral lines in strongly ionized plasma, 18: 26710 (AEC-tr-6227/1(p.15-24))
MARK, J. T., Ultrahigh vacuum device, 18: 26999
MARKIV, V. Ye., Crystal structure of Ta_3Ga_5, 18: 26043
MARKOVIC, H., Determination of D_2O–2% enriched U lattice parameters, 18: 26886
MARKOVIC, V., Spin fluctuation scattering of neutrons on pyrrhotite, 18: 26498 (PAN-280)
MARKOVICH, P. J., X-ray instrument utilizing radioisotope sources, 18: 25275
MARPLE, L. W., Anion exchange behavior of U and Th in mixed solvent systems, 18: 25383
MARPLE, L. W., Sorption of Pb on anion exchange resin, 18: 25384
MARPLE, L. W., Sorption of rare earths on anion exchange resins, 18: 25395
MARSHALL, David, Complications following radiotherapy, 18: 25167
MARTELL, A. E., Equilibrium studies of uranyl complexes. I., 18: 25391
MARTIN, A. I., Eccentric point source in spherical reactor, 18: 26869
MARTIN, D. F., Chelating tendencies of 2-(pyridyl)-1,3-indanediones, 18: 25457
MARTIN, Richard M., Reactions of hot H atoms. II., 18: 25561
MARTIN, Richard M., Reactions of hot H atoms. I., 18: 25560
MARTIN, Richard McKelvy, Gas phase photochemical reactions, 18: 25597
MARTINI, M., Fast transistorized amplifier with large dynamic range, 18: 25793 (NAS-NRC-Pub-1184(p.89-95))
MASAIKE, Akira, Reactions induced by high-energy bremsstrahlung, 18: 26589

MASUBUCHI, K., Cracking in high-strength steel weldments, 18: 25941 (DMIC-197)

MATANO, Keiichi, Thin-film cryotrons. A review. II., 18: 26476

MATHESON, Max S., Formation and detection of intermediates in H_2O radiolysis, 18: 25576

MATSUDA, Koji, Beta dose measurements with compensated calorimeter, 18: 25829 (AEC-tr-6372(p.29-34))

MATSUDA, Koji, Energy dissipation distribution of β rays in matter, 18: 26812 (AEC-tr-6372(p.11-15))

MATSUDA, Koji, Measurement of β current density, 18: 25830 (AEC-tr-6372)

MATSUDA, Koji, Radiation-induced thermoluminescence of polyethylene, 18: 25471 (AEC-tr-6372(p.49-59))

MATSUDA, Koji, Radiation-induced thermoluminescence of benzene derivatives, 18: 25472 (AEC-tr-6372(p.61-74))

MATSUDA, Koji, Radiation-induced thermoluminescence of trioxane and dioxane, 18: 25473 (AEC-tr-6372(p.75-82))

MATSUDA, Koji, Transmission of β rays through several materials, 18: 26813 (AEC-tr-6372(p.17-28))

MATSUI, Ichiro, Effects of total-body x irradiation on serum Fe of rabbits, 18: 25164

MATSUMOTO, Shinji, Excited states in P-29, 18: 26593

MATTHES, Franz, Precipitation of rare earth metals on Hg cathodes, 18: 25620

MATTHEWS, D. L., Electrons in disturbed ionospheric E-region, 18: 26455

MATTHEWS, P. T., K_1^0-K_2^0 transition in a Coulomb field, 18: 26319

MATUSDA, Akiya, Stoichiometric number of H electrode reaction in presence of isotopic effect, 18: 25400

MATYUSHENKO, N. N., Diffusion in Mo–Be system, 18: 26013

MAUD, Fred, Irradiation vault, 18: 25600

MAURICE, Francoise, Electron probe microanalyzer: fluorescence excited by continuous radiation, 18: 26105 (CEA-R-2421)

MAURICE, M., Corrosion of C and stainless steels in water and steam. I., 18: 25922 (EURAEC-1038)

MAXWELL, Charles R., Radiolysis of aqueous glycine, 18: 25584

MAY, M., Bombardment of Dy with protons at 9 to 87 Mev, 18: 26584

MAYER, J., Energy transfer in radiolysis of solid systems. II., 18: 25545

MAYER, James W., Linear semiconductor junction radiation detector, 18: 25858

MAYKUTH, Daniel J., Tungsten granules make strong sheet, 18: 25950

MAYS, Charles W., Fallout Pu-239 and Zr-95 in lungs of deer, 18: 25693

MAZEAU, Jean, Predischarges under very low pressures, 18: 26715

MAZING, M. A., Broadening and shift of Al(III) spectral lines in strongly ionized plasma, 18: 26710 (AEC-tr-6227/1(p.15-24))

MAZING, M. A., Spectroscopic studies of toroidal discharge, 18: 26792

MAZOR, E., Geochemistry of P, F, U, and Ra in marine rocks, 18: 25686

MAZUMDAR, A. S. Ghosh, Action of H_2O_2 on Pu solutions, 18: 25390

MC ALLISTER, Lawrence Edward, Improvements in frequency convertors, 18: 25637

MC AVOY, Nelson, Spectra and quantum states of Eu β-diketone chelates, 18: 25462

MC CARTHY, I. E., Parity rule for inelastic scattering, 18: 26651

MC COLLUM, W. A., Prog. rpt. on radiation effects on electrode behavior, 6–8/63, 18: 26067 (AI-8971)

MC CRAY, Elmo M., Jr., Sexually sterile males for control of *Aedes aegypti*, 18: 25047

MC CULLOCH, E. A., Hemopoietic colony-forming cells transplanted into irradiated mice, 18: 25189

MC CULLOCH, R. D., Parity in Σ^- interaction with He, 18: 26278 (ORNL-3582(p.129))

MC CUNE, James E., Wave growth and instability in partially ionized gases, 18: 26689 (BSD-TDR-64-34)

MC DONALD, R. L., Anodic oxidation of chloride to perchlorate, 18: 25386

MC DONALD, Wendy, Acquired immunological tolerance in the adult mouse, 18: 25157

MC DOWELL, M. R. C., Asymptotic form of impulse approximation electron capture cross section, 18: 26228

MC GEE, R. X., Sky survey of neutral hydrogen at γ 21 cm. III., 18: 26191

MC GINNIS, Gerald A., Low cost digital tape store, 18: 25889

MC GOWAN, F. K., Coulomb excitation of vibrational triplet states and octupole states in even Cd nuclei, 18: 26551 (ORNL-3582(p.107-11))

MC GOWAN, F. K., Coulomb excitation of Br-81 with α particles, 18: 26552 (ORNL-3582(p.112-14))

MC GOWAN, J. Wm., Effect of vibration excitation of H_2^+, 18: 26207

MC ILROY, R. W., Mass spectrometer and isotope separator facilities at AERE, 18: 25740 (EANDC(UK)-25L)

MC ILWAIN, Carl E., Spectrum of protons in earth's radiation belt, 18: 26244

MC KAY, Edward J., Geological map of the Topopah Spring SW Quadrangle, Nevada, 18: 26986 (TEI-846)

MC KELLAR, Bruce H. J., Velocity-dependent potentials and shell model of O-18, 18: 26639

MC KISSON, R. L., Prog. rpt. on solubility and diffusion of ultra-pure transition elements, 12/29/63–3/28/64, 18: 25314 (AI-64-75)

MC LACHLAN, D., Jr., Atomic vibrations and the melting process in metals, 18: 25990

MC LATCHIE, W., Neutron separation energies for isotopes of Hg, Tl, Pb, and Bi, 18: 26576

MC MASTERS, O. D., Crystallographic lattice type and cell constants, 18: 26108 (IS-839)

MC MILLAN, Peter William, Manufacture of neutron-absorbing materials, 18: 25958

MC NAUGHT, R. A., Multidimensional kicksorter using magnetic-tape storage, 18: 25824 (NAS-NRC-Pub-1184(p.305-12))

MC TAGGART, M. H., Zero-energy fast reactor VERA, 18: 26876

MC WHORTER, R. J., General Electric core design philosophy, 18: 26826

MEADEN, G. T., Superconductivity in Np and Pu, 18: 26473

MEADEN, G. T., Superconductivity of the actinide metals, 18: 26475

MEADOWS, J. W., "On-line" operation of a digital computer, 18: 25888

MEGERTH, F. H., Fuel rods containing sintered UO_2 extrusions, 18: 25942 (GEAP-4556)

MEHTA, M. L., Calculation of mass and width of ω from ρ and π, 18: 26341

MEIER, Gilbert W., Early behavioral analysis of γ-irradiation effects, 18: 25190

MEIER, R. W., MINOR—subcritical facility for heavy-water lattice studies, 18: 26882

MEISSNER, Guenther, Calculation of passage of fast electrons through material, 18: 26823

MEISTER, H. J., Mott scattering of electrons by screened Au and Hg nuclei, 18: 26236

MEKHEDOV, V. N., Investigation of At produced in bombardments of Bi and Pb with high-energy particles, 18: 26602

MELIK-GAIKAZYAN, I. Ya., Radiation stability of alkali-halide crystals, 18: 25585

MELTZER, C. M., Observation of reaction $\bar{p} + d \rightarrow \Lambda + \Sigma^- + \Xi^+$, 18: 26334

MELTZER, Robert J., Apparatus for determining γ- or x-ray dosage, 18: 25855

MENDE, H., Economic assessment of various evaporator types, 18: 25643

MENDELL, Rosalind Bronner, Fast neutron flux in atmosphere, 18: 26101

MENZIES, Robert Marshall, Improvements in voluteless centrifugal pumps, 18: 25673

MERARD, R., Thermionic cathodes and magnetron effect, 18: 26256

MEREDITH, John L., Evaluation of internal radiac detector positions, 18: 25709 (NDL-TR-49)

MERICLE, Leo W., Radiation effects on nucleic acids during embryonic development. I., 18: 25175

MERIEL, Yves, Breeders will avoid waste of natural U, 18: 26940

MERKEL, George, Nuclear shell effects in Ni-58 reactions, 18: 26599

MERMAZ, M., Analysis of angular correlations of excitation functions, 18: 26634

MERRIAM, George R., Jr., Radiation effects on cataract production, 18: 25200

MERRYMAN, R. G., Temperature measurement precision in Debye-Scherrer specimens, 18: 26109 (LA-2687)

MESERVEY, R., Tunneling between superconducting films. I., 18: 26487

MESERVEY, R., Tunneling between superconducting films. II., 18: 26488

METCALF, A., Neutron-activation technique for O determination, 18: 25304

METCALF, Arnold, Determining ash content of coal, 18: 25311

METCHNIK, V., Intensities of Kα radiation from inclined Cu target, 18: 26205

MEYER, Andreas, Intermetallic compounds in system Ho–Al, 18: 26036

MEYER, G., Lithium protective gas generator, 18: 25933

MEYEROTT, A. J., Plastic scintillator response to 1- to 10-kev photons, 18: 25845
MEZENTSEV, A. I., Telecobalt therapy of late phases of malignant tumors, 18: 25254
MICHALOWSKI, A., Effect of x rays on incorporation of thymidine into Ehrlich's ascites tumor of mice, 18: 25173
MICHALOWSKI, Adam, Radiation effects on incorporation of thymidine into Ehrlich carcinoma, 18: 25166
MICHELSON, Donne C., Ion exchange procedures. III., 18: 25295
MIEHER, Robert, Exchange polarization of the self-trapped hole in LiF, 18: 25414
MIETTINEN, Jorma K., Body burden of Cs-137 in people of Southern Finland 1961–1963, 18: 25687 (NP-13981)
MIETTINEN, Jorma K., Measurements of Cs-137 in Finnish Lapps in 1962–63, 18: 25710 (NP-13984)
MIETTINEN, Jorma K., Radioactive food chains in Arctic regions, 18: 25055 (NP-13985)
MIGDAL, A. B., Systems in external field, 18: 26386 (NP-13958)
MIKHAILOV, V. A., Salts of dialkyl phosphoric, 18: 25429
MILLER, Donald H., Analysis of 1.0- to 1.4-Bev π-ρ enhancement, 18: 26346
MILLER, J. M., Reactions of α particles with Sc-45, 18: 26649
MILLER, M. A., Field structure within plasma layer of zero permeability, 18: 26726
MILLER, M. A., Two-dimensional EM fields guided by plasma layers. I., 18: 26725
MILLER, M. W., Radio-protective chemicals, 18: 25222
MILLER, P. D., Helium-3-induced charged-particle reactions, 18: 26549 (ORNL-3582(p.100-1))
MILLER, R., Wire chamber—computer system, 18: 25779 (CONF-182-15)
MILLER, R. A., Heating vacuum-tube cathodes with Po-210, 18: 25870 (MLM-1154)
MILLER, W. F., GUS multicomputer system, 18: 25885
MILNE, D. K., Extended radio sources. I., 18: 26190
MILNER, W. T., Coulomb excitation of vibrational triplet states and octupole states in even Cd nuclei, 18: 26551 (ORNL-3582(p.107-11))
MILTON, Jessee A., Sky survey of neutral hydrogen at γ 21 cm. III., 18: 26191
MILWARD, Gervaise Luigi, Improvements in extraction of Be, 18: 25625
MINEGAWA, Nemiko, Radiation-induced graft polymerization on cellulose. XIII., 18: 25481 (AEC-tr-6372(p.129-34))
MINEGAWA, Nemiko, Radiation-induced graft polymerization on cellulose. VII., 18: 25475 (AEC-tr-6372(p.89-96))
MINEGAWA, Nemiko, Radiation-induced graft polymerization on cellulose. IX., 18: 25477 (AEC-tr-6372(p.103-8))
MINEGAWA, Nemiko, Radiation-induced graft polymerization on cellulose. X., 18: 25478 (AEC-tr-6372(p.109-15))
MINEGAWA, Nemiko, Radiation-induced graft polymerization on cellulose. XI., 18: 25479 (AEC-tr-6372(p.117-23))
MIRONOV, E. S., Calculating focusing system of two quadrupole magnets, 18: 26178
MISNER, C. W., Dynamical stability of neutron star models, 18: 26199
MISTI-DORELLO, P., X-ray-induced formation of cysteamine from cystamine, 18: 25542
MITCHELL, J. M., Profession and nuclear warfare, 18: 25732
MITRA, A. P., Loss and drift terms in the ionospheric F region, 18: 26443
MIYACHI, Yoshihiko, Bound states in full symmetry theory, 18: 26361
MOAK, C. D., Nanosecond pulsing for Van de Graaff accelerators, 18: 26176
MOAK, C. D., Reactions $Mg(\alpha,\alpha)Mg^{24}$ and $Mg^{24}(\alpha,\alpha')Mg^{24*}$, 18: 26550 (ORNL-3582(p.101-2))
MOAZED, K. L., Field-emission microscopy of metal crystal nucleation, 18: 26054
MOEBIUS, Guenther, Thorotrast tumors of the liver, 18: 25205
MOGHISSI, A., Thin layer ionophoresis of inorganic materials with use of radionuclides, 18: 25612 (ORNL-tr-128)
MOHAMMED, Saleh, Separation of carrier-free Sc isotopes, 18: 25298
MOI, M. E., Cesium vapor dispenser, 18: 25759
MOISEEV, S. S., Anomalous plasma diffusion in magnetic field, 18: 26772
MOLINARI, V. G., Solution of energy-dependent Boltzmann equation, 18: 26500
MOLLENAUER, J. F., Excited states of He-4, 18: 26528 (BNL-7983)
MONARI, L., Lifetime of $_{\Lambda}H^{3}$, 18: 26527 (BNL-837(p.454-6))
MONCALVO, F., Peroxidase activity of chemo-antibiotic-resistant mycobacteria subjected to x irradiation, 18: 25111
MONCHICK, L., Small periodic disturbances in polyatomic gases, 18: 26135
MONGODIN, G., Vacuum tightness at isotope separation plant, 18: 25682
MONROE, R. E., Cracking in high-strength steel weldments, 18: 25941 (DMIC-197)
MONSTAFA, D., Scattered radiation in diagnostic application of x rays, 18: 25255
MONTES, J., Design and construction of miniature fission chamber, 18: 25860
MOOKHERJI, A., Rare-earth ions in state of solution, 18: 25350
MOOKHERJI, T., Rare-earth ions in state of solution, 18: 25350
MOONEY, Richard W., Copper-activated Th phosphate phosphors, 18: 25376
MOORE, Fletcher L., Liquid-liquid extraction of radio Sn, 18: 25274
MOORE, R. A., Gas flows through electric arcs: hot gas containment limits, 18: 26687 (ARL-64-49)
MOORE, Raymond H., Plutonium recovery from nuclear fuel, 18: 25630
MORABITO, J. J., Sodium components in reactor systems, 18: 26829
MORAN, P. R., Resonance studies of F centers in KCl. I., 18: 25412
MORAVCSIK, Michael J., Spin-zero photoproduction parity experiments, 18: 26310
MOREAU, J., MC-10 leak detector cell: Helitest 2002, 18: 25761
MORET-BAILLY, J., Spectral index measurements in H_2O-moderated bare homogeneous assemblies, 18: 26885
MORETON-SMITH, M. J., Gold as heat dispersant in exothermic solid-gas reactions, 18: 25420
MORGAN, G. W., Current status of AEC-state cooperative program, 18: 25715
MORGAN, H. W., Optical physics, 18: 26114 (ORNL-3582(p.36-7))
MORI, Kiyohiko, Radiation-induced thermoluminescence of β-propiolactone, 18: 25498 (AEC-tr-6372(p.287-90))
MORI, S., Corrosion research, 18: 25920 (ANL-6868(p.338-54))
MORINIGO, Fernando B., Pure Coulomb distortions in (X,n) stripping reactions, 18: 26646
MORIYAMA, Hideo, Studies on X agent. XXII., 18: 26144
MORIYAMA, Hideo, Studies on X agent. XXIII., 18: 26145
MORIYAMA, Hideo, Studies on X agent. XXV., 18: 26146
MORLAN, Harvey B., Sexually sterile males for control of *Aedes aegypti*, 18: 25047
MOROZOV, A. I., Steady-state axially symmetric flow of plasma across azimuthal field, 18: 26773
MOROZOVA, T. D., Absolute age in Loess soils of Russian Steppe, 18: 25685
MOROZOVA, V. P., Leptospirosis antibodies in irradiated rabbits, 18: 25228
MORPURGO, M., Design of 100-kG d-c magnet, 18: 26167 (CERN-64-23)
MORRIS, D. F. C., Determination of Hg in rocks, 18: 25307
MORRIS, D. F. C., Extraction of some metal bromides by TBP, 18: 25382
MORRIS, J. B., Counter diffusion of gases in nuclear graphite, 18: 26061
MOSCOU, L., Electron microscopic investigation of irradiation damage to small nuclear fuel particles, 18: 26081
MOSES, H. E., Generalizations of the Jost functions, 18: 26304
MOSKINOV, V. A., Extraction of U(VI) by mono-2,4-diethyloctylorthophosphoric acid, 18: 25623
MOSS, M., Extraction of Pu with triethylene glycol dichloride, 18: 25603 (CEI-18)
MOURAD, W. G., Orbitron ionization gage, 18: 25757
MUCHNIK, M., Fission and fragmentation at high energies, 18: 26608
MUELLER, Arno, Reactor with a pressure vessel, 18: 26853
MUELLER, C. B., Mechanical constraints on critical currents of superconducting surface of Nb_3Sn on Nb, 18: 26464
MUELLER, D., Properties of sensitive proportional counter, 18: 25834
MUELLER, G., Decay of Mo-93, 18: 26595
MUELLER, K. A., Nuclear magnetic resonance of La-139 and Al-27 in La aluminate, 18: 26625
MUELLER, K. A., Spectrum of Fe^{3+} in $SrTiO_3$, 18: 25409
MUGIBAYASHI, Nobumichi, Asymptotic limits of operators in fixed-source theory, 18: 26430
MUKHERJEE, Asok Kumar, Chemistry of noble gases, 18: 25401
MUKHERJEE, K., Correlation between energy of motion of monovacancies

and melting temperature of metals, 18: 26037
MUKHON'KO, K. P., Elution of radioactive dust from atmosphere, 18: 25692
MULHOLLAND, John H., Effect of thorotrast on lymph and serum bilirubin levels, 18: 25060
MULLEN, G. H., Canonical property and asymptotic reduction procedures, 18: 26313
MULLER, J., Industrial applications of denitration processes in French U cycle, 18: 25342
MULLIN, C. R., Luminescence quenching in liquid systems, 18: 25563
MUNTZ, James H., Determination of Ti and Zr in Mo, 18: 25268 (ML-TDR-64-36)
MURATOV, V. I., Probe beam investigation of plasma oscillations, 18: 26777
MURMANN, R. K., Synthesis of C-deuterated ethylenediamine dihydrobromide, 18: 25458
MURPHY, E. A., Prog. rpt. on Be wire, 2-4/64, 18: 25938 (AD-439498)
MURPHY, Richard Dodds, Beta-γ directional correlation studies of La-140, 18: 26683
MURRAY, P., Advances in nuclear ceramics, 18: 26059
MUTSCHLECNER, Joseph Paul, Abundance of Li, Be, and Pb in solar atmosphere, 18: 26202
MUXART, Roland, Absorption spectra of HF solutions of Pu^{++}, 18: 25344

N

NABATOV, V. V., Triboluminescence in LiF crystals, 18: 25419
NABY, G. A., Production of carrier-free F-18, 18: 25875
NACHTRIEB, Norman H., Nuclear magnetic resonance in molten salts. I., 18: 25361
NACHTRIEB, Norman H., Probes for high-temperature NMR, 18: 25758
NAGIEV, M. F., Recycle process in chemical engineering, 18: 25647
NAGLE, Richard J., Formation of compound nucleus Po-210 in systems Pb^{206} + α and Bi^{209} + p, 18: 26647
NAKAI, Yoto, Beta dose measurements with compensated calorimeter, 18: 25829 (AEC-tr-6372(p.29-34))
NAKAI, Yoto, Energy dissipation distribution of β rays in matter, 18: 26812 (AEC-tr-6372(p.11-15))
NAKAI, Yoto, Measurement of β current density, 18: 25830 (AEC-tr-6372 (p.35-47))
NAKAI, Yoto, Radiation-induced thermoluminescence of polyethylene, 18: 25471 (AEC-tr-6372(p.49-59))
NAKAI, Yoto, Radiation-induced thermoluminescence of benzene derivatives, 18: 25472 (AEC-tr-6372(p.61-74))
NAKAI, Yoto, Radiation-induced thermoluminescence of trioxane and dioxane, 18: 25473 (AEC-tr-6372(p.75-82))
NAKAI, Yoto, Radiation-induced thermoluminescence of β-propiolactone, 18: 25498 (AEC-tr-6372(p.287-90))
NAKAI, Yoto, Transmission of β rays through several materials, 18: 26813 (AEC-tr-6372(p.17-28))
NAKAJIMA, Yoshiharu, Effect of radiation on polyoxymethylene, 18: 25514 (AEC-tr-6372(p.437-43))
NAKAJIMA, Yoshiharu, Effect of radiation on polyethylene glycol, 18: 25515 (AEC-tr-6372(p.445-53))
NAKAJIMA, Yoshiharu, ESR of irradiated cyclohexene, 18: 25523 (AEC-tr-6372(p.495-8))
NAKAJIMA, Yoshiharu, ESR of irradiated N-hexadecyne-1, 18: 25524 (AEC-tr-6372(p.499-501))
NAKAJIMA, Yoshiharu, Radiation behavior of polyoxymethylene and polyethylene glycol, 18: 25516 (AEC-tr-6372(p.455-8))
NAKAJIMA, Yutaka, Excited states in P-29, 18: 26593
NAKAMURA, M., Multiparameter pulse-height recording system, 18: 25823 (NAS-NRC-Pub-1184(p.287-91))
NAKAMURA, Yoko, Radiation-induced polymerization of vinylene type monomers, 18: 25491 (AEC-tr-6372(p.207-12))
NAKANE, Ryohei, Complex formation of B fluoride with lower olefins at low temperatures. II., 18: 25341
NAKAO, Yoshio, Effect of x rays on secondary formation of gills in *Branchiura sowerbyi*, 18: 25135
NAKATA, M. M., Thermal properties of refractory materials, 18: 25986 (WADD-TR-60-581(Pt.IV))
NALEVSKAYA, L. A., Young's modulus anomalies in rare earth ferromagnets, 18: 26005
NARASINGA RAO, B. C., Loss and drift terms in the ionospheric F region, 18: 26443
NASEDKIN, Yu. F., Various states of compression of plasma loop in Zb-O installation, 18: 26704 (AEC-tr-5589(p.689-708))
NASH, G. F., Excited states in mass-twelve nuclei, 18: 26624
NATARAJAN, A. T., Fast-neutron-induced tumors in barley, 18: 25178
NATORI, Tadao, Radiation-induced chlorination reactions of polyvinyl chloride, 18: 25504 (AEC-tr-6372(p.349-61))
NATORI, Tadao, Solid-state polymerization of *N*-carboxy acid anhydrides, 18: 25495 (AEC-tr-6372(p.247-59))
NAUDET, R., Critical experiments with thermal neutrons, 18: 26874
NAUENBERG, U., Beta decay of Σ^+ and P^- hyperons, 18: 26354
NECHIPORENKO, E. P., High-temperature oxidation of Mo silicides, 18: 25928
NEDOSPASOV, A. V., Ionic-sound excitation in positive column of gas discharge, 18: 26703 (AEC-tr-5589(p.678-88))
NEDUMOV, N. A., Phase transformations in V-Ta alloys, 18: 26055
NE'EMAN, Yuval, Origins of mass breaking asymmetry, 18: 26335
NEFEDOV, A. P., Phase transformations in V-Ta alloys, 18: 26055
NEGRO, L., Action of P-32 on survival of skin homografts in the rat, 18: 25112
NEGRO, L., Action of uv rays on survival of homologous skin grafts, 18: 25113
NEGRO, L., Action of x rays on homologous skin grafts, 18: 25114
NEILSON, G. C., Identification of charged particles with solid-state detector, 18: 25794 (NAS-NRC-Pub-1184(p.96-103))
NELKIN, Mark, Simple binary collision model for Van Hove's $G_s(r,t)$, 18: 26421
NELSON, Frederick, Ion exchange procedures. II., 18: 25294
NELSON, Frederick, Ion exchange procedures. III., 18: 25295
NELSON, John Berger, Jr., Deuteron capture in C-14, 18: 26682
NELSON, R. W., Transport of fluids in porous media. II., 18: 26975 (HW-72335(Pt.2))
NEMILOV, Yu. A., Variation of the Mössbauer effect in steel, 18: 25903
NERESON, N. G., Magnetic structure of Eu, 18: 26039
NERSES, V., Refractory metal constitution diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
NESTOR, C. W., Jr., Polarization of totally reflected Mössbauer radiation, 18: 26535 (ORNL-3582(p.20-3))
NESTRAKHOV, A. S., Absorption of γ rays in solid fuels during gasification, 18: 25874
NEUMANN, M., Wire chamber—computer system, 18: 25779 (CONF-182-15)
NEUSEN, K. F., Expansion of low-quality two-phase fluid, 18: 25662
NEUWIRTH, Rudolf, Gas-flow counter, 18: 25859
NEWBERY, G. R., Measurement of skin doses from skin contamination, 18: 25083 (AHSB(RP)R-39(p.44-68))
NEWCOM, F. D., Hydraulic sample changer, 18: 26973
NEWDICK, R. E., Twenty-seven-day recurrence of solar protons, 18: 26243
NEWELL, Donald M., Spectrophotometric determination of B in Pu, 18: 25266 (HW-28529)
NEWSOM, Bernard D., Accommodation to stress induced by irradiation, 18: 25100
NEWTON, D., Reaction $B^{11}(p,p')$ at 150 Mev, 18: 26614
NGUYEN VAN-HIEU, Quasi-optical potential in quantum field theory, 18: 26410
NIAS, A. H. W., Continuous irradiation with tritiated H_2O of mammalian cells, 18: 25156
NICHIPORENKO, E. P., Diffusion reaction in Mo-Si system, 18: 26001
NICHOLS, J. P., Possibilities and consequences of major accidents in fuel fabrication and radioisotope processing plants, 18: 25711 (ORNL-3441)
NICHOLS, R. W., Influence of environment on materials for nuclear reactors, 18: 26096
NICHOLSON, A. F., Two-body bound state and scattering with non-central forces, 18: 26285
NICOLL, David, Nuclear reactor fuel handling system, 18: 26860
NICOLL, David, Nuclear reactor having transfer mechanism, 18: 26862
NICOLL, David, Transfer mechanism, 18: 26855
NIELSEN, T. H., Thermal expansion of Y oxide, 18: 25355
NIEMANN, R. L., X-ray instrument utilizing radioisotope sources, 18: 25275
NIESE, S., Determination of Cu in Ga arsenide, 18: 25300

NIGH, Harold Eugene, Electrical resistivity of Gd, 18: 26160
NIJBOER, B. R. A., Scattering of slow neutrons on crystals and fluids. II., 18: 26509
NIJS, W. W., Critical facility KRITO, 18: 26883
NIKOLAEV, N. I., Effect of Co-60 γ radiation on alkaline anion-exchange resins, 18: 25541
NIKOL'SKII, I. K., Instability of plasma in reflection discharge, 18: 26782
NILAN, R. A., Mutation rate in barley, 18: 25182
NIR, A., Interpretation of tritium "age" measurements of groundwater, 18: 25701
NISHIDA, Atsuhiro, Sudden impulses in magnetosphere, 18: 26447
NISHII, Masanobu, Crystal structure of radiation-induced polymers, 18: 25501 (AEC-tr-6372(p.311-21))
NISHII, Masanobu, Epitaxy associated with radiation-induced solid-state polymerization, 18: 25502 (AEC-tr-6372(p.323-30))
NISHII, Masanobu, Radiation-induced polymerization by ring cleavage, 18: 25503 (AEC-tr-6372(p.331-47))
NISHIMURA, K., Interpretation of the Φ-meson, 18: 26320
NISHIMURA, Koichi, Spectrophotometric determination of Nb in Ta, 18: 25284
NITTA, Isamu, Effect of radiation on polyoxymethylene, 18: 25514 (AEC-tr-6372(p.437-43))
NITTA, Isamu, Effect of radiation on polyethylene glycol, 18: 25515 (AEC-tr-6372(p.445-53))
NITTA, Isamu, ESR of irradiated polyisobutylene, 18: 25513 (AEC-tr-6372(p.431-5))
NITTA, Isamu, ESR of irradiated acrylamide, 18: 25517 (AEC-tr-6372 (p.459-64))
NITTA, Isamu, ESR of acrylic acid radical, 18: 25518 (AEC-tr-6372 (p.465-71))
NITTA, Isamu, ESR of irradiated benzene, 18: 25520 (AEC-tr-6372 (p.481-90))
NITTA, Isamu, ESR of irradiated acetone, 18: 25521 (AEC-tr-6372 (p.491-2))
NITTA, Isamu, ESR of irradiated cyclopentadiene, 18: 25522 (AEC-tr-6372(p.493-4))
NITTA, Isamu, ESR of irradiated N-hexadecyne-1, 18: 25524 (AEC-tr-6372(p.499-501))
NITTA, Isamu, ESR of irradiated L-cystine dihydrochloride, 18: 25565
NITTA, Isamu, ESR spectra of irradiated polyethylene, 18: 25512 (AEC-tr-6372(p.421-30))
NITTA, Isamu, Radiation behavior of polyoxymethylene and polyethylene glycol, 18: 25516 (AEC-tr-6372(p.455-8))
NITTA, Isamu, Radiation-induced polymerization of acrylic acid, 18: 25519 (AEC-tr-6372(p.473-80))
NITTA, Isamu, ESR of irradiated cyclohexene, 18: 25523 (AEC-tr-6372(p.495-8))
NIXOLAEV, N. I., Kinetics of ion exchange on sulfocations, 18: 25422
NOGAMI, Yoze, Excited states in P-29, 18: 26593
NOLLET, P., Industrial applications of denitration processes in French U cycle, 18: 25342
NOOMAN, Z., Thorotrast-induced cholangioma, 18: 25147
NORBECK, E., Iowa four-parameter analyzer, 18: 25822 (NAS-NRC-Pub-1184(p.283-6))
NORBECK, E., Position-sensitive solid-state detector, 18: 25784 (NAS-NRC-Pub-1184(p.42-5))
NORDBERG, M. E., Reduced energy spread of synchrocyclotron beams, 18: 26177
NORDEN, A. J., Sensitivity of castorbean to γ rays, 18: 25180
NORDLING, C., Electron spectroscopy for chemical analyses, 18: 25303
NORTHCOTE, Robert S., Isobaric partition function of generalized Tonks' gas, 18: 26134
NORTHROP, Theodore G., Minimum-B plasma equilibria with finite pressure, 18: 26762
NORWOOD, J. M., Magnetic shielding and superconductivity, 18: 26107 (ERR-FW-210)
NOSHKIN, Victor Emil, Jr., Recoil properties of fission products, 18: 26677
NOSWORTHY, Judity M., Trends in radiation chemistry, 18: 25540
NOTOYA, Reiko, Stoichiometric number of H electrode reaction in presence of isotopic effect, 18: 25400
NOVAL, Barry Arnold, New phases in Ta–W–O system, 18: 25444
NOVIKOV, G. I., Dissociation pressure of Sm, Eu, and Y chloride, 18: 25426
NOVIKOV, G. I., Pressure and composition of vapor in KCl systems with Sm, Y, Ca, and Sr, 18: 25435
NOVOSELOVA, A. V., Reactions of Be and Al chloride etherates, 18: 25431
NOVOZHILOV, G. N., Total β activity of water and air areas of Pacific Ocean, 18: 25690
NUYTS, J., Basic SU(3) triplets, 18: 26324
NYSTROEM, Anders, Bibliography on transportation of radioactive materials, 18: 25713 (VDDIT-89)

O

OAE, Shigeru, Formation of S compounds in radiolysis of S solutions, 18: 25548
OAE, Shigeru, Formation of S compounds in radiolysis of toluene solution of S, 18: 25547
OAE, Shigeru, Radiation-induced reaction of benzyl mercaptan and p-tolyl mercaptan, 18: 25549
OAE, Shigeru, Radiation-induced addition of H sulfide to propylene, 18: 25550
OBENSHAIN, F. E., Correlation of Mössbauer isomer shift with residual electrical resistance for Au alloys, 18: 26534 (ORNL-3582(p.16-17))
OBENSHAIN, F. E., Hyperfine splitting in alloys of Fe–Rh, 18: 25982 (ORNL-3582(p.18-19))
OBERMAN, C., Comments on h-f conductivity of fully ionized plasma, 18: 26759
OBERMAN, C., Plasma stability criteria from conservation laws, 18: 26745
O'BRIEN, P. D., Hydraulic sample changer, 18: 26973
OCHI, Hiroshi, Postirradiation polymerization of trioxane, 18: 25500 (AEC-tr-6372(p.299-310))
O'CONNOR, D. A., Elastic nuclear resonant scattering of Fe-57 γ rays, 18: 26657
O'CONNOR, D. A., Nuclear resonant scattering in single crystals, 18: 26656
O'CONNOR, D. A., Scattering of resonant radiation by crystals, 18: 26658
O'CONNOR, J. R., Stimulated emission from $CeF_3:Nd^{3+}$, 18: 26119
O'CONNOR, K. J., Jaundice after halothane and radiotherapy, 18: 25119
ODIAN, A., Two-body effective mass spectra in $\gamma + p \rightarrow p + \pi^+ + \pi^-$, 18: 26353
OEFJORD, K., Void effects in zero-power critical facility NORA, 18: 26884
O'FOGHLUDHA, F., Radiation reciprocity in scattering medium, 18: 25245
OFTE, Donald, Preparation of Pu-bearing oxide particulates, 18: 26008
OGAWA, Keiichi, Dislocation structures in Mo and Mo–Re alloys, 18: 26063
OGAWA, Seiji, Irradiation-graft polymerization of styrene of rayon, 18: 25534 (AEC-tr-6372(p.593-602))
OGDEN, Horace R., Tungsten granules make strong sheet, 18: 25950
OGIMOTO, Takesi, Anti-shrinkage of the p-p diffraction scattering, 18: 26365
OHARA, Saburo, Radiation-induced thermoluminescence of polyethylene, 18: 25471 (AEC-tr-6372(p.49-59))
OHARA, Saburo, Radiation-induced thermoluminescence of benzene derivatives, 18: 25472 (AEC-tr-6372(p.61-74))
OHARA, Saburo, Radiation-induced thermoluminescence of trioxane and dioxane, 18: 25473 (AEC-tr-6372(p.75-82))
OHARA, Sachiko, Autoxidation of unsaturated fatty acids irradiated with x rays, 18: 25570
OHLENDORF, W., Azimuthal pinch discharges in H, 18: 26735
OHLMANN, Robert C., Fluorescence properties of Eu dibenzoylmethide, 18: 25455
OHMURA, Haruko, Excited states in P-29, 18: 26593
OHNISHI, Shun-ichi, ESR of irradiated L-cystine dihydrochloride, 18: 25565
OKABAYASHI, T., Conservation law of parity, 18: 26314
OKADA, Norio, Beta-induced polymerization of styrene, 18: 25486 (AEC-tr-6372(p.163-73))
OKADA, Norio, Beta-induced crosslinking of polyvinyl alcohol, 18: 25488 (AEC-tr-6372(p.185-92))
OKADA, Norio, Beta irradiation of acetylated polyvinyl alcohol, 18: 25489 (AEC-tr-6372(p.193-5))

OKADA, Norio, Effect of boric acid during heating or irradiation of polyvinyl alcohol, 18: 25487 (AEC-tr-6372(p.175-84))
OKADA, Norio, Radiation-induced graft polymerization on cellulose. VI., 18: 25474 (AEC-tr-6372(p.83-8))
OKADA, Norio, Radiation-induced graft polymerization on cellulose. VII., 18: 25475 (AEC-tr-6372(p.89-96))
OKADA, Norio, Radiation-induced graft polymerization on cellulose. VIII., 18: 25476 (AEC-tr-6372(p.97-102))
OKADA, Norio, Radiation-induced graft polymerization on cellulose. IX., 18: 25477 (AEC-tr-6372(p.103-8))
OKADA, Norio, Radiation-induced graft polymerization on cellulose. X., 18: 25478 (AEC-tr-6372(p.109-15))
OKADA, Norio, Radiation-induced graft polymerization on cellulose. XI., 18: 25479 (AEC-tr-6372(p.117-23))
OKADA, Norio, Radiation-induced graft polymerization on cellulose. XII., 18: 25480 (AEC-tr-6372(p.125-7))
OKADA, Norio, Radiation-induced graft polymerization on cellulose. XIII., 18: 25481 (AEC-tr-6372(p.129-34))
OKADA, Norio, Radiation-induced graft polymerization on polyvinyl alcohol. XV., 18: 25482 (AEC-tr-6372(p.135-40))
OKADA, Norio, Radiation-induced graft polymerization on polyvinyl alcohol. XVI., 18: 25483 (AEC-tr-6372(p.141-3))
OKADA, Norio, Radiation-induced graft polymerization of conjugated diene monomer, 18: 25484 (AEC-tr-6372(p.145-57))
OKADA, Norio, Radiation-induced graft polymerization on polyvinyl alcohol, 18: 25485 (AEC-tr-6372(p.159-61))
OKADA, Norio, Reactions of irradiated polymer with Cl_2–SO_2, 18: 25490 (AEC-tr-6372(p.197-205))
OKAMURA, Seizo, Crystal structure of radiation-induced polymers, 18: 25501 (AEC-tr-6372(p.311-21))
OKAMURA, Seizo, Epitaxy associated with radiation-induced solid-state polymerization, 18: 25502 (AEC-tr-6372(p.323-30))
OKAMURA, Seizo, Postirradiation polymerization of trioxane, 18: 25500 (AEC-tr-6372(p.299-310))
OKAMURA, Seizo, Radiation-induced polymerization of vinylene type monomers, 18: 25491 (AEC-tr-6372(p.207-12))
OKAMURA, Seizo, Radiation-induced polymerization of formaldehyde. III., 18: 25492 (AEC-tr-6372(p.213-22))
OKAMURA, Seizo, Radiation-induced polymerization of ketene types. I., 18: 25493 (AEC-tr-6372(p.223-35))
OKAMURA, Seizo, Radiation-induced polymerization of ketene types. II., 18: 25494 (AEC-tr-6372(p.237-46))
OKAMURA, Seizo, Radiation-induced polymerization of phosphonitrile chloride, 18: 25496 (AEC-tr-6372(p.261-72))
OKAMURA, Seizo, Radiation-induced polymerization of oxetane derivatives, 18: 25497 (AEC-tr-6372(p.273-86))
OKAMURA, Seizo, Radiation-induced thermoluminescence of β-propiolactone, 18: 25498 (AEC-tr-6372(p.287-90))
OKAMURA, Seizo, Radiation-induced polymerization by ring cleavage, 18: 25503 (AEC-tr-6372(p.331-47))
OKAMURA, Seizo, Radiation-induced chlorination reactions of polyvinyl chloride, 18: 25504 (AEC-tr-6372(p.349-61))
OKAMURA, Seizo, Solid-state polymerization of *N*-carboxy acid anhydrides, 18: 25495 (AEC-tr-6372(p.247-59))
OKAMURA, Seizo, Uv-induced solid-state polymerization of β-propiolactone, 18: 25499 (AEC-tr-6372(p.291-7))
OKUDA, Takeo, Preparation of anhydrous UF_4, 18: 25448
O'LAUGHLIN, Jerome W., Separation of cations by reversed-phase partition chromatography, 18: 25614
OLESEN, P., Bound states in quantum field theory, 18: 26414
OLIVER, John, Improvement in reactor cores, 18: 26848
OLIVER, R., Parameters for multi-target and multi-hit survival curves, 18: 25170
OLIVIER, Joseph, Mounting device for fuel element assemblies, 18: 26961
OLIVIERI, Angelo, Dose-effect relation in induction of crossing-over, 18: 25108
OLIVIERI, Gregorio, Dose-effect relation in induction of crossing-over, 18: 25108
OLSEN, C. E., Magnetic structure of Eu, 18: 26039
OLSEN, H. Smith, Effectiveness of control rods in HBWR, 18: 26948
OLSSON, Per O. M., Partial differential equations associated with the Appell function F_2, 18: 25884
OMIDVAR, Kazem, Excitation of H atom induced by electron impact, 18: 26203 (NASA-TN-D-2145)
OMNES, Roland L., Three-body scattering amplitude. I., 18: 26336
O'NEILL, John Joseph, Solution properties of stereoregular polyacids, 18: 25463
ONISHI, Shunichi, Effect of radiation on polyoxymethylene, 18: 25514 (AEC-tr-6372(p.437-43))
ONISHI, Shunichi, Effect of radiation on polyethylene glycol, 18: 25515 (AEC-tr-6372(p.445-53))
ONISHI, Shunichi, ESR of irradiated N-hexadecyne-1, 18: 25524 (AEC-tr-6372(p.499-501))
ONISHI, Shunichi, ESR of irradiated polyisobutylene, 18: 25513 (AEC-tr-6372(p.431-5))
ONISHI, Shunichi, ESR of irradiated acrylamide, 18: 25517 (AEC-tr-6372 (p.459-64))
ONISHI, Shunichi, ESR of acrylic acid radical, 18: 25518 (AEC-tr-6372 (p.465-71))
ONISHI, Shunichi, ESR of irradiated benzene, 18: 25520 (AEC-tr-6372 (p.481-90))
ONISHI, Shunichi, ESR of irradiated acetone, 18: 25521 (AEC-tr-6372 (p.491-2))
ONISHI, Shunichi, ESR of irradiated cyclopentadiene, 18: 25522 (AEC-tr-6372(p.493-4))
ONISHI, Shunichi, ESR of irradiated cyclohexene, 18: 25523 (AEC-tr-6372(p.495-8))
ONISHI, Shunichi, ESR spectra of irradiated polyethylene, 18: 25512 (AEC-tr-6372(p.421-30))
ONISHI, Shunichi, Radiation behavior of polyoxymethylene and polyethylene glycol, 18: 25516 (AEC-tr-6372(p.455-8))
ONISHI, Shunichi, Radiation-induced polymerization of acrylic acid, 18: 25519 (AEC-tr-6372(p.473-80))
ONO, T., Radiation injury in tissue culture, 18: 25117
ONODA, Ichiro, Uranium addition to low-C steels. I., 18: 26044
OPPENHEIM, I., Field correlation functions in plasma, 18: 26750
OPPENHEIMER, F., Baryon-exchange model in isobar production, 18: 26351
OPPENHEIMER, F., Λ-p elastic scattering, 18: 26347
OPPENHEIMER, F., Trapping of Λ hyperons in nuclear matter, 18: 26623
OPRAVIL, Oldrich, Isolation of carbide phase from Ti–W alloyed Cr–Ni steel, 18: 25289
ORMAN, S., Uranium compatibility studies. II., 18: 25921 (AWRE-O-25/64)
ORNER, G., High-pressure high-temperature metallurgy, 18: 25972 (ASD-TDR-63-90(Vol.II))
O'ROURKE, R. G., Prog. rpt. on Be wire, 2–4/64, 18: 25938 (AD-439498)
OSAKA, Yukio, Effect of Coulomb interaction on ultrasonic attenuation, 18: 26408
OSAKIEWICZ, W., Energy spectrum of α particles from $La^{139}(n,\alpha)Cs^{136}$ reaction at 14.1 Mev, 18: 26606
OSBORN, S. B., Radiation hazards in the Ra wards, 18: 25719
OSHIMA, Keiichi, Reaction of metallic W and F gas, 18: 25332 (UCRL-Trans-1044(L))
OSOVETS, S. M., Various states of compression of plasma loop in Zh-O installation, 18: 26704 (AEC-tr-5589(p.689-708))
OSSICINI, L., Chromatography on ion exchange papers. XII., 18: 25374
OSTROVSKAYA, L. K., Use of N-15 in investigating role of Cu in plant assimilation of ammonia and nitrate N, 18: 25059 (OTS-63-11008(p.6-14))
OSUGA, Shigehiro, Beta dose measurements with compensated calorimeter, 18: 25829 (AEC-tr-6372(p.29-34))
OSUGA, Shigehiro, Measurement of β current density, 18: 25830 (AEC-tr-6372(p.35-47))
OSUGA, Shigehiro, Transmission of β rays through several materials, 18: 26813 (AEC-tr-6372(p.17-28))
OTWINOWSKI, Wieslaw, Determination of Cu, Zn, and As in acids, 18: 25286
OYAMA, Toshiyuki, Complex formation of B fluoride with lower olefins at low temperatures. II., 18: 25341
OZAWA, Y., Plasma waves with small amplitude, 18: 26729
OZEROV, R. P., Neutron diffraction study of perovskite-like substances, 18: 25418
OZISIK, M. N., Fission-product deposition from gas streams, 18: 26939

P

PACK, D. C., Reflection and diffraction of shock waves, 18: 26123
PAIS, A., Notes on W, and related symmetries, 18: 26350
PAIS, A., Scattering formalism for singular potential theory, 18: 26415
PAIS, A., Singular potentials and perstization. II., 18: 26407
PAKHOMOV, V. Ye., Production of high magnetic fields, 18: 26474
PAN, C. H. T., Spiral-grooved, self-acting, gas bearing, 18: 25640 (TID-20632)
PANTALEO, R., Polypeptides of the liver in animals subjected to irradiation of the liver, 18: 25110
PAOLINI, F. A., Peroxidase activity of chemo-antibiotic-resistant mycobacteria subjected to x irradiation, 18: 25111
PAPAPETROU, A., Identities in general relativity and unified field theory, 18: 26389
PAPINEAU, L., Analysis of angular correlations of excitation functions, 18: 26634
PAPIOV, I. I., Beryllium and Cr whiskers, 18: 26009
PAPIROV, I. I., Tempering of Be–Ni alloys, 18: 26005
PAPPALARDO, Romeo, Reflection spectra of lanthanides in ThO_2, 18: 25423
PARKER, G. W., Fission of oriented nuclei, 18: 26554 (ORNL-3582 (p.121-6))
PARKER, James Evans, Neutron-proton collisions, 18: 26376
PARKER, K., Data listing program for U.K.A.E.A. Nuclear Data Library, 18: 25879 (AWRE-O-4/64)
PARKER, P. D., Excited states of He-4, 18: 26528 (BNL-7983)
PARKS, Paul Blair, III, Properties of (p,n) reactions in tenuous gases, 18: 26672
PARODI, L., Digital position indicator for control rods, 18: 26834
PASECHNIK, M. V., Scattering of 0.5- and 0.8-Mev neutrons, 18: 26568
PASECHNIK, M. V., Scattering of 0.5- to 0.8-Mev neutrons, 18: 26571
PASMA, P., High-resolution neutron total cross sections, 18: 26543 (ORNL-3582(p.75-82))
PATARAYA, A. D., Structure of wave propagating across magnetic field, 18: 26785
PATE, J. B., Mutations in cotton induced by γ irradiation of pollen, 18: 25129
PATEL, Yogendra M., Effects of radiation on protein, nucleic acid and RNA synthesis by Strain L, 18: 25209
PATERSON, Ian Laird McKenzie, Improvements in nuclear reactor fuel loading arrangements, 18: 26846
PATERSON, W. J., Zero-energy fast reactor VERA, 18: 26876
PATRUSHEV, B. I., Propagation of EM waves in plasma along magnetic field, 18: 26699 (AEC-tr-5589(p.596-611))
PATTERSON, G. N., Mechanics of rarefied gases and plasmas, 18: 26688 (ARL-64-60)
PATTERSON, R. L., Jr., Characteristics of air filter media used for monitoring airborne radioactivity, 18: 26098 (NRL-6054)
PATTERSON, R. L. S., Gamma-induced decomposition of amides in CCl_4, 18: 25572
PATTORET, Andre, Apparatus for the preparation of pure metals, 18: 25912
PATWARDHAN, P. K., Analog-to-digital converter, 18: 25809 (NAS-NRC-Pub-1184(p.180-3))
PATWARDHAN, P. K., Time-shared computer for real-time information processing, 18: 25883 (NAS-NRC-Pub-1184(p.271-82))
PAUL, P., Excited state at 25 Mev in Be-8, 18: 26617
PAULY, T., Orbitron ionization gage, 18: 25757
PAVLICHENKO, O. S., Instability of plasma in reflection discharge, 18: 26782
PAVLICHENKOW, I. M., Intensity ratios of electromagnetic transitions, 18: 26628
PAVLOV, E. I., Various states of compression of plasma loop in Zh-O installation, 18: 26704 (AEC-tr-5589(p.689-708))
PAVLOV, V. S., Vapor pressure over solid Be, 18: 26014
PAVLOVA, Z. I., Strength and decomposition of solid solutions of WC–Co, 18: 26004
PAVLOVSKAYA, G. R., Reduction of uranyl carbonate complexes, 18: 25428
PAWELEK, J., Electric surface potentials of aqueous solutions of organic bases, 18: 25450
PAYA, D., Parameters of low-energy resonances in W, 18: 26539 (ORNL-3582(p.58-60))
PEARCE, Dennis W., Removing Ru from aqueous solutions, 18: 25632
PEARCE, K. D., Parameters of low-energy resonances in W, 18: 26539 (ORNL-3582(p.58-60))
PEASE, L. F., Refractory metal constitution diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
PEELLE, R. W., Neutron time-of-flight zero-cross-over pulse shape discriminator, 18: 25803 (NAS-NRC-Pub-1184(p.146-9))
PEETERMANS, A., Absolute and relative efficiency of NaI(Tl) crystal, 18: 25865
PEHL, Richard H., Comparison of $O^{18}(p,t)$ and (p,He^6) reactions, 18: 26653
PEIERLS, Rosald F., Restrictions imposed by optical theorem on exchanged quantum numbers, 18: 26337
PELERENTS, C., Gamma effects on farina moth, 18: 25125
PELLAT, R., Marginal stability condition for stationary non-dissipative motions, 18: 26738
PELLAT, R., Movement of helical plasma segment, 18: 26741
PELLEGRINI, Umberto, Flexibility of standard pulse-height analyzer for multiparameter experiments, 18: 25819 (NAS-NRC-Pub-1184(p.237-8))
PEMSLER, J. P., Hydrogen in proton-bombarded Be, 18: 26093
PENDLEBURY, E. D., Data listing program for U.K.A.E.A. Nuclear Data Library, 18: 25879 (AWRE-O-4/64)
PENDLETON, Robert C., Fallout Pu-239 and Zr-95 in lungs of deer, 18: 25693
PENDURAKAR, H. K., Photovoltaic cell x-ray exposure rate meter, 18: 25867
PENNINGTON, Edwin M., Collision probabilities in cylindrical lattices, 18: 26872
PEREL'MAN, F. M., Yttrium and Gd or La nitrate systems, 18: 25434
PERES, Asher, Dirac's wave equation in a gravitational field, 18: 26403
PERGAMENT, M. I., Compression of plasma by rapidly increasing magnetic field, 18: 26698 (AEC-tr-5589(p.565-84))
PERKS, Maurice Arthur, Improvements in fast nuclear reactors, 18: 26889
PERMYAKOVA, T. V., Preparation of La silicates, 18: 25433
PERONA, G., Autoclave with forced circulation, 18: 25639 (CISE-99)
PERSON, James C., Gaseous ion recombination rates. II., 18: 26210
PERSSON, Lars, Level scheme of Tb-155, 18: 26566
PESKIN, Richard L., Effect of suspended solids on Lagrangian properties of fluid turbulence, 18: 25656 (NYO-2930-2)
PETERSEN, G. T., General Electric core design philosophy, 18: 26826
PETERSON, Loren R., Prog. rpt. on improvement of BWR stability, 1–4/64, 18: 26924 (EURAEC-1065)
PETIT, G. S., Determination of Sr-90 in drinking water, 18: 25267 (K-1521)
PETKOVIC, Lj. V., Determination of CO_2, H_2, and O_2 in aqueous solutions, 18: 25273 (AEC-tr-6227/1(p.9-14))
PETRANOVIC, N. A., Separation of U from some cations, 18: 25611 (AEC-tr-6227/1(p.1-8))
PETRANYI, Gyoza, Disturbances of water circulation in experimental intestinal x-ray death, 18: 25155
PETRUKHIN, V. I., Pion beta decay, 18: 26273 (BNL-837(p.344-52))
PETUSHKOV, A. A., Air circulation in operational areas of high-level γ installations, 18: 25718
PEUSTER, K., Nuclear power station Gundremmingen, 18: 26932
PFEIFER, V., Analysis of nuclear fuel. I., 18: 25610 (SGAE-CH-4/1964)
PFEIFER, V., Analysis of nuclear fuel elements. I., 18: 26903
PFOTZER, G., Radioactive debris from HA nuclear explosions, 18: 26099
PHILLIPS, J. C., New collective resonance in "free-electron" metal, 18: 26226
PHILLIPS, Lawrence E., Mercury–steam binary power cycle, 18: 26949
PHIPPS, J. A., Total ionization in Ar by heavy ions, 18: 26217
PHIPPS, Kenneth D., Preparation of Pu-bearing oxide particulates, 18: 26008
PIATT, Jean, Ear in x-irradiated parabionts of Amblystoma, 18: 25148
PICCIOTTO, E., Antarctic snow chronology with Pb-210, 18: 25702
PICKETT, A. G., Fatigue strength of pressure vessels, 18: 25680 (TID-20648)
PIEKENBROCK, L., Λ-p elastic scattering, 18: 26347
PIERCE, C. B., Optical absorption spectra in alkali halides, 18: 25408
PIERCE, J. F., Field effect transistors in low-noise wideband voltage and charge-sensitive preamplifiers, 18: 25812 (NAS-NRC-Pub-1184(p.204-6))
PIERUCCI, O., Effect of radiation on splenomegaly, 18: 25223
PIGNOTTI, A., Unitary spin assignment for the ω meson, 18: 26323

PIKE, M. C., Lymphocytes from irradiated patients, 18: 25158
PINAJIAN, J. J., Thin layer ionophoresis of inorganic materials with use of radionuclides, 18: 25612 (ORNL-tr-128)
PINDOR, A., Angular distributions in reaction $\bar{p} + p \rightarrow \pi + \rho$, 18: 26286
PINTO, L. J., Dissolution and assay of elemental B, 18: 25276
PIONTKOVSKII, I. A., Higher nervous activity in animals prenatally exposed to ionizing radiation, 18: 25121
PIROUE', P. A., Adiabatic light pipe for improved light collection and timing, 18: 25785 (NAS-NRC-Pub-1184(p.46-7))
PISANKO, A. I., Spectroscopic studies of toroidal discharge, 18: 26792
PIZER, H. I., Pulse analyzers in CERN, 18: 25783 (NAS-NRC-Pub-1184 (p.18-22))
PIZZELLA, Rito, Neutron irradiation of solid acetylhydrazide, 18: 25556
PLAKHOV, A. G., Radiation from faintly luminous pulsed plasma, 18: 26743
PLANO, R. J., Beta decay of Σ^+ and P^- hyperons, 18: 26354
PLASIL, F., Energy-mass distributions in induced fission, 18: 26558 (UCRL-11377)
PLATZER, Roger, Apparatus for the preparation of pure metals, 18: 25912
PLECHKOV, V. M., Measurements of radiation from moon and sun, 18: 26192
PLOEGER, F., Preparation of U compounds, 18: 25403
PLOTNIKOV, A. F., Energy levels in electron-irradiated Si, 18: 26089
POLETTI, G., Magnetic quenching of positronium decay in H_2O, 18: 26221
POLICEC, Septimio, Extraction of Zr–alizarin S complex with butanol, 18: 25306
POLISHCHUK, P. A., Electric conductivity of oxide–fluoride melts, 18: 25432
POLLACK, S. A., Spectrum of trivalent Er in CaF_2, 18: 25359
POLOVIN, R. V., Laminar theory of shock waves in plasma, 18: 26740
POL'SKII, Yu. E., Electron paramagnetic resonance of Gd^{3+} in CaF_2, 18: 25416
POLYACHENKO, A. L., Theory of non-stationary diffusion of thermal neutrons in infinite medium, 18: 26506
POLYACHENOK, O. G., Dissociation pressure of Sm, Eu, and Y chloride, 18: 25426
POLYACHENOK, O. G., Pressure and composition of vapor in KCl systems with Sm, Y, Ca, and Sr, 18: 25435
POMERANCHUK, I. Yu., High-energy behavior of elastic scattering amplitude, 18: 26322
POMRANING, G. C., Energy averaging of the diffusion coefficient, 18: 26517
POMOMAREV-STEPNOI, N. N., Critical assemblies with Be moderator, 18: 26248
POOR, C. F., Reactor engineering data system, 18: 26955 (HW-81088)
POPIC, R. V., Reactor neutron flux distribution determination, 18: 26865 (AEC-tr-6227/1(p.47-9))
POPOV, A. F., Character of instability from interaction of electron beam with plasma, 18: 26706 (AEC-tr-5589(p.767-72))
POPOV, I. A., Niobium–Mo–Zr alloys, 18: 26056
POPOV, M. M., Vapor pressure of tritium oxide, 18: 25436
POPOV, Yu. P., Capture cross section of Cr, Cr-50, Cr-52, and Cr-53 for neutrons up to 50 kev, 18: 26570
POPPE, Erik, The acute radiation syndrome, 18: 25227
POPPENDIEK, Heinz F., Fuel channel elements for circulating fuel reactors, 18: 26857
POPRYADUKHIN, A. P., Force lines in stellarator magnetic field, 18: 26790
PORILE, N. T., Products formed by 2.9-Bev proton irradiation of Ag, 18: 26648
PORTE, A., Liver in Lacerta and Accara after ThO_2 injection, 18: 25066
POSHUSTA, Ronald Dean, Potential curve of metastable He molecule, 18: 26155
POSSAGNO, Elvira, Neutron irradiation of solid acetylhydrazide, 18: 25556
POSSELT, K., Radiochemical polymerization of polyvinyl chloride, 18: 25569
POTTER, N. D., Thermodynamic properties of Li and Mg halides, 18: 25360
POTTS, Renfrey B., Isobaric partition function of generalized Tonks' gas, 18: 26134
POUND, G. M., Field-emission microscopy of metal crystal nucleation, 18: 26054
POWERS, D., Elastic scattering of α particles by O-18, 18: 26645
POYEN, Jacques, $K^+ + p \rightarrow K^0 + \pi^+ + p$ effective cross section, 18: 26288
POZDNYAKOV, A. A., Reduction of Tc(VII) by HCl, 18: 25352
PRAG, Rudolf, Scanning device for radiation diagnosis, 18: 25258
PRAGER, Stephen, Spiral flow in stationary porous pipe, 18: 25669
PRASAD, A. N., Azimuthal pinch discharges in H, 18: 26735
PRASILOVA, J., Complexity constants of Ho and Yb acetylacetonates, 18: 25385
PRATT, Ira P., Stress field pinning in hard superconductors, 18: 26469
PRAVDIVYI, N. M., Scattering of 0.5- to 0.8-Mev neutrons, 18: 26571
PREIBISZ, Z., Possible four-quasiparticle excited state of Er-166, 18: 26632
PRENTICE, Theodore C., Serum erythropoietic factor in anemia of malignancy, 18: 26988 (TID-20635)
PRESLAND, A. E. B., Nucleation of grain-boundary cavities in Mg, 18: 26021
PRETZER, Donovon Donald, Proton collisions with the rare gases, 18: 26235
PRICE, William J., Nuclear Radiation Detection, 18: 25850
PRIETO, F. E., Research with nuclear reactor, 18: 26966
PRINCE, Kenneth, Improvements relating to thermal nuclear reactors, 18: 26836
PRINCE, Norman, Improvements relating to thermal nuclear reactors, 18: 26836
PROKOSHKIN, Yu. D., Pion beta decay, 18: 26273 (BNL-837(p.344-52))
PROKSCH, E., Irradiation capsules for reactor irradiation of organic liquids, 18: 25543
PROSSER, Reese T., Convergent perturbation expansions for certain wave operators, 18: 26401
PROSSER, Reese T., Segal's quantization procedure, 18: 26400
PROTTI, A. M., Activation energy of sintering non-stoichiometric UO_2, 18: 26030
PRPIC, B., Evaluation of average dose of radiation in occupationally exposed persons, 18: 25717
PRPIC, B., Selection of personnel for work with radiation, 18: 25716
PUECHL, Karl H., Prog. rpt. on Pu fuel materials, 2/64, 18: 25895 (NUMEC-2389-3)
PUECHL, Karl H., Prog. rpt. on Pu fuels, 1/64, 18: 26901 (NUMEC-2389-2)
PUGACHEVA, E. V., Effectiveness of control rods containing moderating material, 18: 26832
PUGH, H. Ll. D., New trends in metal working, 18: 25955
PUKOV, T. Chi, Deferred surgical treatment of firearm wounds with radiation sickness, 18: 25202
PURI, R. K., Radiation length in nuclear emulsions, 18: 26295
PUTT, G. D., New energy level in Ne-20 at 10.31 Mev, 18: 26574

Q

QAIM, S. M., New isotope of Pb: Pb-213, 18: 25869
QUANE, D., Naphthazarin and β-hydronaphthazarin chelates, 18: 25456
QUARRINGTON, J. A., Time-shared computer for real-time information processing, 18: 25883 (NAS-NRC-Pub-1184(p.271-82))
QUINLAN, Frank B., Cladding of nuclear fuel elements, 18: 25962
QUINN, John J., Conductivity tensor of an anisotropic quantum plasma, 18: 26761
QUINTILIANI, M., X-ray-induced formation of cysteamine from cystamine, 18: 25542
QUIRK, John F., Sintered beryllia and bentonite product, 18: 25965

R

RAAEN, Helen P., ORNL master analytical manual indexes, 18: 25271 (TID-7015(Indexes)(Rev.1))
RABIN, Herbert, F band in isotopically enriched LiF, 18: 25410
RABINOWITCH, J., Effects of diagnostic irradiation, 18: 25152
RADAK, V. M., Separation of U from some cations, 18: 25611 (AEC-tr-6227/1(p.1-8))
RADCLIFFE, S. V., High-pressure high-temperature metallurgy, 18: 25972 (ASD-TDR-63-90(Vol.II))
RADEKA, V., Field-effect transistors in charge-sensitive amplifiers,

18: 25791 (NAS-NRC-Pub-1184(p.70-8))
RADIVOJEVIC, D. V., Effects of whole-body and local x irradiation on reproductive ability, 18: 25215 (AEC-tr-6227/1(p.25-44))
RADTKE, Edward W., Seal for moving electron beam column, 18: 25964
RADWAN, Zofia, Determination of La, Nd, and Pr, 18: 25288
RAICH, John Carl, *Ortho-para* transition in molecular H, 18: 26153
RAISIC, N., Determination of D_2O–2% enriched U lattice parameters, 18: 26886
RAJA GOPAL, E. S., Vibrations of quantized vortices in liquid He II, 18: 26483
RAJAN, K. S., Equilibrium studies of uranyl complexes. I., 18: 25391
RALL, W., Thin-foil transmission electron-microscopic study of neutron-irradiated A212B steel, 18: 26092
RAMAKRISHNAN, Alladi, Note on use of Wick's theorem, 18: 26398
RAMASWAMY, M. K., Interpretation of 5^- levels in even-even nuclei, 18: 26579
RAMASWAMY, M. K., Mixing ratios (M_1-E_2) in even-even nuclei, 18: 26580
RAMASWAMY, M. K., Note on M4 transitions, 18: 26208
RAMM, C. A., CERN neutrino beam, 18: 26165 (BNL-837(p.91-113))
RAMSEY, N. F., Magnetic resonance with large angular momentum, 18: 26422
RAND, S., Transfer of energy in quantized plasma, 18: 26749
RANDONE, G., Magnetic quenching of positronium decay in H_2O, 18: 26221
RAO, B. Ramachandra, Drift and anisotropy of the E- and the F-region irregularities, 18: 26441
RAO, G. Gopala, Titrimetric determination of Ce(III), 18: 25308
RAO, P. Balarama, Drift and anisotropy of the E- and the F-region irregularities, 18: 26441
RAO, P. Kanta, Titrimetric determination of Ce(III), 18: 25308
RAO, S. Bhanojee, Titrimetric determination of Ce(III), 18: 25308
RAPENEAU, Jean, Tubular guide and heat-insulator unit for nuclear reactors, 18: 26835
RAPP, Karl E., Uranium density of systems, 18: 25324 (K-1609)
RAPPERPORT, E. J., Constitution diagram W–Ru, 18: 26045
RAPPERPORT, E. J., Hydrogen in proton-bombarded Be, 18: 26093
RASMUSSEN, J. O., Theoretical calculations of properties of rare-earth α emitters, 18: 26640
RATLIFF, John L., Tungsten granules make strong sheet, 18: 25950
RATTI, S., Lifetime of ${}_{\Lambda}H^3$, 18: 26527 (BNL-837(p.454-6))
RAY, W. E., Hydrogen content of fabricated U, 18: 25943 (HW-30116)
RAYBURN, L. A., Reactions $Mg(\alpha,\alpha)Mg^{24}$ and $Mg^{24}(\alpha,\alpha')Mg^{24*}$, 18: 26550 (ORNL-3582(p.101-2))
RAYMUND, M., Binding energy difference between He^4_{Λ} and H^4, 18: 26622
RAYUDU, G. V. S., Radionuclide productions in thick iron targets with 1- and 3-Bev protons, 18: 26583
READ, I. A., Effect of D on photo-oxidation of CH_3I, 18: 25587
REAY, N. W., Reduced energy spread of synchrocyclotron beams, 18: 26177
RECHT, H. L., Prog. rpt. on radiation effects on electrode behavior, 6–8/63, 18: 26067 (AI-8971)
REDHEAD, P. A., Interaction of slow electrons with chemisorbed O, 18: 26206
REDMAN, L. A., Nuclear Energy, 18: 26241
REEDER, H. O., Tritium as ground-water tracer, Eddy County, N. Mex., 18: 25684 (TEI-839)
REEVE, John Charles, Improvements in extraction of Be, 18: 25625
REGAN, Michael Colin, Production of U–C alloys, 18: 25963
REGELSON, W., Effect of radiation on splenomegaly, 18: 25223
REGNAUD, F., Analysis of Pu, 18: 25291
REICH, B., Effects of neutron radiation on secondary breakdown, 18: 25756
REICH, Michael, F band in isotopically enriched LiF, 18: 25410
REID, Colin David, Improvements in fuel elements, 18: 26908
REID, George C., Physical processes in D region of ionosphere, 18: 26457
REILLY, M. H., Atomic multipole interactions in rare-gas crystals, 18: 26223
REISENAUER, A. E., Transport of fluids in porous media. II., 18: 26975 (HW-72335(Pt.2))
REITER, Bruno, Improvements relating to grab devices, 18: 26844
REIZENSTEIN, Peter, Iron-59 absorption measurements by whole-body counting and fecal recovery, 18: 25072
RENBERG, P. U., Quasi-free p-p scattering in light nuclei, 18: 26567
RENKEN, C. J., Electromagnetic system applied to inspection of thin-walled tubing, 18: 25674 (ANL-6728)
RESHCHIKOVA, A. A., Lanthanum tellurides, 18: 25430
REXROAD, Ralph E., Evaluation of internal radiac detector positions, 18: 25709 (NDL-TR-49)
REYES, Zoila, Radiation-induced reactions in swollen polymers, 18: 25469 (SRIA-120)
REYKHRUDEL, E. M., Gas discharge ion source, 18: 25655
REYNTENS, H., Radiation as mutagenic agent in fodder crop improvement, 18: 25126
REZIKYAN, A. M., Distribution of partial pressure of negative ions in discharge column, 18: 26720
RHEAUME, R. H., Amplifier for particle accelerators, 18: 26184
RHO, M., Theoretical calculations of properties of rare-earth α emitters, 18: 26640
RICCI, R. A., Decay of the $f_{7/2}$ in Pb-207, 18: 26603
RICE, F. O., Production and identification of free radicals, 18: 25329 (TID-20645)
RICE, S. A., Perturbation calculation of mixed-pair correlation functions, 18: 26133
RICHARDS, Hubert Lyle, Scattering of metastable He atoms, 18: 26237
RICHARDS, K. J., Oxidation kinetics of Ta in CO_2, 18: 25935
RICHMOND, Donald R., Environmental effects at Hiroshima and Nagasaki, 18: 25722
RICHTER, W., Thermal and temperature conductivity of porous sintered materials, 18: 25987 (NP-tr-1247)
RICKEY, B., Trapping of Λ hyperons in nuclear matter, 18: 26623
RIEDLER, W., Radioactive debris from HA nuclear explosions, 18: 26099
RIEGER, E., Sintering processes for Th powder compacts, 18: 25951
RIEMERSMA, H., Flux jumping and degradation in superconducting solenoids, 18: 26463
RIESZ, Peter, Radiolysis of acetone in aqueous solutions, 18: 25582
RIGHINI, B., Multichannel transistorized pulse-height analyzer, 18: 25805 (NAS-NRC-Pub-1184(p.165-8))
RILEY, C. J., Separation of H isotopes during distillation, 18: 25309
RILEY, N., Magnetohydrodynamic free convection, 18: 26124
RIMINI, A., Causes of inaccuracy in analog-to-digital conversion, 18: 25811 (NAS-NRC-Pub-1184(p.186-94))
RIMINI, A., Properties of a class of nonlocal solvable interactions, 18: 26404
RIN, Chun-Hsun, Effect of suspended solids on Lagrangian properties of fluid turbulence, 18: 25656 (NYO-2930.2)
RINELLI, G., Adsorption measurements by membrane electrodes, 18: 25327 (RT/GEO(64)-1)
RINZIVILLO, R., Fission and fragmentation at high energies, 18: 26608
RITTERSHAUS, Elfriede, Reflection spectra of lanthanides in ThO_2, 18: 25423
RIVES, John Edgar, Properties of liquid of He-3 below 1°K, 18: 25439
RIVIELLO, Richard, Rare earth oxyfluorides, 18: 25318 (CONF-405-39)
ROBB, W., Ion exchange on ammonium molybdophosphate. II., 18: 25378
ROBERTS, C. S., Effects of irradiation on field effect and injection transistors, 18: 25741 (N64-13153)
ROBERTS, F., Counter diffusion of gases in nuclear graphite, 18: 26061
ROBERTS, L. D., Correlation of Mössbauer isomer shift with residual electrical resistance for Au alloys, 18: 26534 (ORNL-3582(p.16-17))
ROBERTS, L. D., Hyperfine splitting in alloys of Fe–Rh, 18: 25982 (ORNL-3582(p.18-19))
ROBERTS, L. E. J., Chemical aspects of nuclear ceramic development, 18: 26060
ROBERTS, William Owen, Sodium–Sr equilibrium system, 18: 25984 (TID-20639)
ROBERTSON, D. F., Acute radiation exposure of superficial tissue, 18: 25146
ROBINSON, D. K., Observation of reaction $\bar{p} + d \rightarrow \Lambda + \Sigma^- + \Xi^+$, 18: 26334
ROBINSON, John Albert, Improvements in reactor fueling arrangements, 18: 26847
ROBINSON, John Albert, Thermocouple arrangements for nuclear reactor fuel elements, 18: 25766
ROBINSON, L. B., "Ramp-pulser" for testing linearity of pulse-analysis systems, 18: 25816 (NAS-NRC-Pub-1184(p.216-19))
ROBINSON, R. L., Coulomb excitation of vibrational triplet states and octupole states in even Cd nuclei, 18: 26551 (ORNL-3582(p.107-11))

ROBINSON, R. L., Coulomb excitation of Br-81 with α particles, 18: 26552 (ORNL-3582(p.112-14))
ROBINSON, R. L., Elastic scattering of 17- to 21-Mev neutrons from C-12, 18: 26547 (ORNL-3582(p.93-4))
ROBINSON, V. J., New isotope of Pb: Pb-213, 18: 25869
ROCKWOOD, Curtis C., Low cost digital tape store, 18: 25889
RODE, Ivan, Tissue tolerance to telecobalt radiation, 18: 25192
RODIER, Jean, Manufacture of products containing radioactive materials, 18: 26980
RODIONOVA, N. G., Niobium–Mo–Zr alloys, 18: 26056
RODRIGUEZ, C., Deformation mechanisms of beta U single crystals, 18: 26029
ROESLER, Fred L., Behavior of He II 3s, p, d-4s, p, d, f line complex plasma, 18: 26219
ROETHIG, D. T., Plastic scintillator response to 1- to 10-kev photons, 18: 25845
ROGERS, A. J., Heating vacuum-tube cathodes with Po-210, 18: 25870 (MLM-1154)
ROGERS, Philip W., Linear bending analysis of pressurized multicell shell structure, 18: 25633 (ERR-AN-336)
ROHACH, Alfred Franklin, Economic integration of nuclear power, 18: 26944
ROLF, R. F., Determination of U in Zr alloys, 18: 25283
ROLL, J. A., Power distributions and control worths in two-region clustered UO_2–D_2O lattice, 18: 26863 (CVNA-134)
ROLLAND, Paul, Window problem in cylindrical geometry, 18: 26690 (DI-82-0217)
ROLLAND, William Woody, Reaction $N^{14}(d,n)O^{15}$, 18: 26673
ROMAN, P., Connection between Kemmer algebras and unitary groups, 18: 26303
ROMANOV, E. P., Electric conductivity of Mo monocrystals, 18: 26007
ROMANYUK, L. I., Penetration of plasma from source with electron oscillations to evacuated region with magnetic field, 18: 26711 (FTD-TT-64-400)
ROMO, Harry D., Beta radiation backscatter gage, 18: 25769
RON, A., Comments on h-f conductivity of fully ionized plasma, 18: 26759
RON, Amiram, Quantum kinetic equations for electrons in a periodic system, 18: 26405
ROOK, J. R., Optical model and distorted wave analysis of (He^3,t) reactions, 18: 26596
ROOKHUYZEN, P. Van, Neutron separation energies for isotopes of Hg, Tl, Pb, and Bi, 18: 26576
RORK, G. D., Primary ionization coefficient measurements in Penning mixtures, 18: 26220
ROSA, Umberto, Introduction into portal vein of new colloidal complex labeled with P-32, 18: 25075
ROSEBROCK, T. L., Repetitive pulsed acceleration of plasmas, 18: 26809
ROSE-INNES, A. C., Critical currents of a superconductor, 18: 26472
ROSENBLATT, D. B., Effect of irradiation upon adsorption by alumina catalyst, 18: 25468 (BNL-845)
ROSENBLATT, Leon, Survival of x-irradiated beagles, 18: 25094 (UCD-472-109(p.173-7))
ROSENBLUM, B., Thermodynamic critical field in type-I superconductors, 18: 26480
ROSENBLUM, Bruce, Normal regions in superconducting mixed state, 18: 26489
ROSENFELD, Arthur H., Search for Y_1^* resonances, 18: 26328
ROSENKRANG, W., High-strength stress-corrosion-resistant alloy with AlZnMg base. II., 18: 25946 (RSIC-177)
ROSENWASSER, H., Differential thermal analysis of basic rare earth azides, 18: 25446
ROSS, Eric, Improvements in or relating to U alloys, 18: 25910
ROSS, J. G., Irradiation-induced mutations in sorghum, 18: 25130
ROSS, Marc H., Unitarity and form factors in production process $\pi + N \rightarrow \rho + N$, 18: 26348
ROSSI, L , Irradiation of the heart with Co-60, 18: 25109
ROTENBERG, Arthur Daniel, Body scanning, 18: 25257
ROTH, Paul C. J., Use of ionizing radiations in medicine, 18: 25194
ROTHBART, M., Decontamination of Savannah River waste supernate, 18: 26974 (BNL-853)
ROTHERHAM, L., Advances in metallurgical practice introduced for nuclear engineering, 18: 25901
ROTHMAN, Milton A., Ion cyclotron resonance in plasmas, 18: 26739
ROUND, Kenneth John, Improvements in chemical processing apparatus, 18: 25626
ROUSSET, A., Leptonic decay of hyperons, 18: 26274 (BNL-837(p.355-77))
ROUX, J. P., Hazard of Sr-90 as fallout product, 18: 25697
ROVELLI, R., Irradiation of the heart with Co-60, 18: 25109
ROWAN, J. H., X-ray fluorescence tables: LiF crystal, 18: 25330 (Y-1470-C)
ROWAN, J. H., X-ray fluorescence tables: EDDT crystal, 18: 25449 (Y-1470-D)
ROWE, D. J., Reaction $B^{11}(p,p')$ at 150 Mev, 18: 26614
ROWLEY, D. A., Mast cell damage and vascular injury in the rat, 18: 25065
ROY, M. Deb, Dating of some nuclear explosions from radioactive fallout measurements, 18: 25691
ROZANOV, A. I., Reversibility of β–ω transformation in Zr–16% Nb alloys, 18: 26003
RUBBIA, Carlo, Muon capture in hydrogen, 18: 26271 (BNL-837(p.277-91))
RUBERTI, U., Cytochemical findings in the liver after irradiation, 18: 25141
RUBIN, Stanley Gerald, Magneto-gasdynamic channel flows, 18: 26805
RUBINS, R. S., Spectrum of Fe^{3+} in $SrTiO_3$, 18: 25409
RUDERMAN, M., Astrophysics and fundamental neutrino interactions, 18: 26187 (BNL-837(p.193-233))
RUDOLPH, O. B., Optical physics, 18: 26114 (ORNL-3582(p.36-7))
RUETTIMANN, A., Results of medical radiation research. I., 18: 25256
RUFIAN, E., Design and construction of miniature fission chamber, 18: 25860
RUGGIERI, E., Action of P-32 on survival of skin homografts in the rat, 18: 25112
RUGGIERI, E., Action of uv rays on survival of homologous skin grafts, 18: 25113
RUGGIERI, E., Action of x rays on homologous skin grafts, 18: 25114
RUKHADZE, A. A., Charged-particle interactions with plasma, 18: 26781
RUSANOV, V. D., Propagation of EM waves in plasma along magnetic field, 18: 26699 (AEC-tr-5589(p.596-611))
RUTHER, W. E., Corrosion research, 18: 25920 (ANL-6868(p.338-54))
RUTHERFORD, P., Kinetic theory of weakly unstable plasma, 18: 26712
RUTKEVICH, B. N., Probe beam investigation of plasma oscillations, 18: 26777
RYABCHIKOV, D. I., Reduction of Tc(VII) by HCl, 18: 25352
RYAN, Ann Marie, Cross-induction process in *E. coli* K12, 18: 25210
RYDE, Hans, Level scheme of Tb-155, 18: 26566
RYKALIN, V. I., Pion beta decay, 18: 26273 (BNL-837(p.344-52))

S

SAAVEDRA, I., Analyticity of the Jost functions, 18: 26311
SAGDEEV, R. Z., Shock waves in dilute plasma, 18: 26697 (AEC-tr-5589 (p.554-64))
SAIF, M., Thorotrast-induced cholangioma, 18: 25147
SAKAMOTO, Masahiro, Uv-induced solid-state polymerization of β-propiolactone, 18: 25499 (AEC-tr-6372(p.291-7))
SAKAMOTO, Y., Reaction (p,pd), 18: 26643
SAKURADA, Ichiro, Beta-induced polymerization of styrene, 18: 25486 (AEC-tr-6372(p.163-73))
SAKURADA, Ichiro, Beta-induced crosslinking of polyvinyl alcohol, 18: 25488 (AEC-tr-6372(p.185-92))
SAKURADA, Ichiro, Beta irradiation of acetylated polyvinyl alcohol, 18: 25489 (AEC-tr-6372(p.193-5))
SAKURADA, Ichiro, Effect of boric acid during heating or irradiation of polyvinyl alcohol, 18: 25487 (AEC-tr-6372(p.175-84))
SAKURADA, Ichiro, Radiation-induced graft polymerization on cellulose. VI., 18: 25474 (AEC-tr-6372(p.83-8))
SAKURADA, Ichiro, Radiation-induced graft polymerization on cellulose. VII., 18: 25475 (AEC-tr-6372(p.89-96))
SAKURADA, Ichiro, Radiation-induced graft polymerization on cellulose. VIII., 18: 25476 (AEC-tr-6372(p.97-102))
SAKURADA, Ichiro, Radiation-induced graft polymerization on cellulose. IX., 18: 25477 (AEC-tr-6372(p.103-8))
SAKURADA, Ichiro, Radiation-induced graft polymerization on cellulose. X., 18: 25478 (AEC-tr-6372(p.109-15))
SAKURADA, Ichiro, Radiation-induced graft polymerization on cellulose.

XI., 18: 25479 (AEC-tr-6372(p.117-23))
SAKURADA, Ichiro, Radiation-induced graft polymerization on cellulose. XII., 18: 25480 (AEC-tr-6372(p.125-7))
SAKURADA, Ichiro, Radiation-induced graft polymerization on cellulose. XIII., 18: 25481 (AEC-tr-6372(p.129-34))
SAKURADA, Ichiro, Radiation-induced graft polymerization on polyvinyl alcohol. XV., 18: 25482 (AEC-tr-6372(p.135-40))
SAKURADA, Ichiro, Radiation-induced graft polymerization on polyvinyl alcohol. XVI., 18: 25483 (AEC-tr-6372(p.141-3))
SAKURADA, Ichiro, Radiation-induced graft polymerization of conjugated diene monomer, 18: 25484 (AEC-tr-6372(p.145-57))
SAKURADA, Ichiro, Radiation-induced graft polymerization on polyvinyl alcohol, 18: 25485 (AEC-tr-6372(p.159-61))
SAKURADA, Ichiro, Reactions of irradiated polymer with Cl_2–SO_2, 18: 25490 (AEC-tr-6372(p.197-205))
SALAM, A., K_2^0-K_2^0 transition in a Coulomb field, 18: 26319
SALAMON, Andras, Determination of tritium in form of water and hydrocarbon, 18: 25301
SALANT, E. O., Observation of reaction $\bar{p} + d \rightarrow \Lambda + \Sigma^- + \Xi^+$, 18: 26334
SALCEDA, Salvador, Basic experiments on cellular death, 18: 25169
SALGO, R. C., Threshold energy of the T(p,n)He^3 reaction, 18: 26616
SALIN, Ph., Determination of Dirac's neutron form factor, 18: 26312
SALIVON, Yu. A., Effects of field cluster on oscillations of particles in accelerators, 18: 26180
SALMON, G. L., Reaction $B^{11}(p,p')$ at 150 Mev, 18: 26614
SALVETTI, Franco, Ion flotation of inorganic ions. I., 18: 25375
SAMELSON, H., Europium chelates as laser materials, 18: 25445
SAMOKHIN, M. V., Distribution of electric and magnetic fields in rotating plasma at thermodynamic equilibrium, 18: 26717
SAMSONOV, G. V., High-temperature materials. II. Properties index, 18: 26064
SAMUELS, L. D., Dose-effect measurements following tritiated thymidine administration, 18: 25069
SANDFAER, Jens, Mutation frequency in different spike categories in barley, 18: 25176
SANGA, L., Shock waves in electrically driven shock tube, 18: 25645
SANGAL, Satendra, Quinizarine sulfonic acid as indicator for Th, 18: 25292
SANKARAN, A., Photovoltaic cell x-ray exposure rate meter, 18: 25867
SANTAMARIA, Leonida, Energetics transfer in photodynamic reaction, 18: 26983 (NYO-2734-1)
SANTORO, M., Changes induced by irradiation on tissues in course of perfusion, 18: 25168
SANTY, Myrrl, Prog. rpt. on Be study, 1–3/64, 18: 25328 (SC-DC-64-864)
SAPP, W. W., Planar dynode multipliers for high-speed counting, 18: 25739 (CONF-182-16)
SARGENT, K. A., Geologic map of Skull Mountain Quadrangle, NTS, 18: 26985 (TEI-845)
SARGOOD, D. G., New energy level in Ne-20 at 10.31 Mev, 18: 26574
SARKAR, B. C. Roy, Strontium in some Indian vegetables, 18: 25067
SARMA, J., Wire chamber—computer system, 18: 25779 (CONF-182-15)
SARTORI, O., Effects of irradiation on the polysaccharide phosphorylase activity in the liver of rats, 18: 25115
SASAKAWA, Tetuya, Determinantal method in perturbation theory, 18: 25886
SASSI, E., Fission and fragmentation at high energies, 18: 26608
SATO, Noriyoshi, Effects of close collisions on ion oscillations in plasma, 18: 26737
SATO, Shigeo, Formulation of quantum electrodynamics, 18: 26428
SATO, Taichi, Extraction of U(VI) from HNO_3 solutions, 18: 25621
SATO, Toshiro, Preparation of Na dimethyldithiocarbamate-^{35}S and K ethylxanthate-^{35}S, 18: 25460
SATO, Toshiro, Preparation of Na *N*-methyldithiocarbamate-^{35}S, 18: 25461
SAUR, E. J., Mechanical constraints on critical currents of superconducting surface of Nb_3Sn on Nb, 18: 26464
SAVARESE, F., Cytochemical findings in the liver after irradiation, 18: 25141
SAVEL'EV, V. A., Hydrogen bond during isotopic substitution in ice, 18: 25417
SAVEL'EVA, M. M., Properties of Nb–Mo–Cr alloys at high temperatures, 18: 26012
SAVITSKII, E. M., Production of high magnetic fields, 18: 26474
SAVITSKII, P. S., Atomic energy and chemical industry, 18: 25872
SAVKOVIC, N. V., Effects of whole-body and local x irradiation on reproductive ability, 18: 25215 (AEC-tr-6227/1(p.25-44))
SAVOSIN, S. I., Actinium–Be sources for industrial geophysical investigations, 18: 25872
SAWADA, Shozo, Fast-neutron absorption dose estimation, 18: 25048
SAWARD, M. P., Solution of two-dimensional axially symmetric multigroup stationary neutron transport equation, 18: 26497 (AWRE-0-66/63)
SAX, Helly J., X-ray-induced chromosome aberrations, 18: 25179
SAX, Karl, X-ray-induced chromosome aberrations, 18: 25179
SBECHNIKOV, V. N., Chromium–Mo phase diagram, 18: 25998
SCARBOROUGH, J. M., Prog. rpt. on solubility and diffusion of ultra-pure transition elements, 12/29/63–3/28/64, 18: 25314 (AI-64-75)
SCARGILL, D., Separation of nitrato- and nitro-complexes of nitrosyl-ruthenium, 18: 25602 (AERE-R-4583)
SCHACHER, G. E., Variation of nuclear spin polarization time, 18: 26652
SCHAFER, W. D., Hydraulic sample changer, 18: 26973
SCHAFSTALL, Heinrich Gustav, Reactor with rod-shaped fuel elements, 18: 26953
SCHANK, S. C., Sensitivity of castorbean to γ rays, 18: 25180
SCHATVET, J., Void effects in zero-power critical facility NORA, 18: 26884
SCHEEL, H., Skin decontamination, 18: 25233
SCHEIDHAUER, Jens, Manufacture of products containing radioactive materials, 18: 26980
SCHEIDWEILER, A., Motion of γ-radiating matter, 18: 25851
SCHELSTRAETE, K., Problems posed by patient with enlarged thyroid, 18: 25237
SCHERM, R., Measurement of small scattering cross sections with subthermal neutrons, 18: 26662
SCHEUER, P. A. G., Extended radio sources. I., 18: 26190
SCHINTLMEISTER, J., Decay of Mo-93, 18: 26595
SCHINZ, H. R., Past, present, and future of radiology, 18: 25246
SCHINZ, H. R., Results of medical radiation research. I., 18: 25256
SCHITTENHELM, R., Transportable 18-Mev betatron for nondestructive testing, 18: 25677
SCHLECHTEN, A. W., Extractive metallurgy of Zr and Hf, 18: 25908
SCHLECHTEN, A. W., Thermodynamic study of the Zr–S system, 18: 26065
SCHLENK, F., Biological transmethylation, 18: 25051
SCHLUEPMANN, K., Effective cross section of photoprotons from N-14, 18: 26633
SCHMATZ, W., Measurement of small scattering cross sections with subthermal neutrons, 18: 26662
SCHMID, William F., Copper-activated Th phosphate phosphors, 18: 25376
SCHMIDT, George, Radiation condition for plasma waves into vacuum, 18: 26755
SCHMIDT, P., Beta decay of Σ^+ and Σ^- hyperons, 18: 26354
SCHMIDT, W., Analysis of the π^+ photoproduction, 18: 26282
SCHMIDT, W. R., Fatigue strength of pressure vessels, 18: 25680 (TID-20648)
SCHMIEDEL, Friedrich, Reactor with rod-shaped fuel elements, 18: 26953
SCHMITT, A. P., Fast-neutron critical mockup, 18: 26875
SCHMOKE, Murray A., Evaluation of internal radiac detector positions, 18: 25709 (NDL-TR-49)
SCHNATTERLY, S., F-aggregate color centers in KCl, 18: 26087
SCHNEEBERGER, M., Capture rate for muons in He-4, 18: 26524 (BNL-837(p.309-13))
SCHNEEBERGER, M., Lifetime of $_\Lambda H^3$, 18: 26527 (BNL-837(p.454-6))
SCHNEIDER, H., Semiconductor particle detectors. II., 18: 25837
SCHOBER, B., Influence of x irradiation on gastric transit time in rat, 18: 25172
SCHOEN, R. I., Shock waves in electrically driven shock tube, 18: 25645
SCHREITER, W., Rare metals. I., 18: 25905
SCHRENK, George Louis, Neutron-proton mass difference, 18: 26374
SCHROCK, V. E., Expansion of low-quality two-phase fluid, 18: 25662
SCHROEDER, R., Response time of "thermocoax", 18: 25754
SCHULTZ, H., Electrical resistivity of cold-worked W, 18: 25993
SCHULTZ, L., Rare gases in stone meteorites, 18: 26197
SCHULZ, J., Fast binary analog-to-digital converter, 18: 25807 (NAS-NRC-Pub-1184(p.172-6))
SCHUPPLI, R., Intermediate detection of biological effects of x rays, 18: 25134

SCHWARZ, Henry P., Radiation effects on DNA of spleen, 18: 25084 (NYO-2568-1)
SCHWARZ, Werner J., Scintillating anion exchange resin, 18: 25259 (NYO-10405)
SCHWINGER, Julian, $\Delta T = \frac{1}{2}$ nonleptonic decay, 18: 26349
SCIBETTA, M. Peter, Sequelae of radical radiotherapy of lung carcinoma, 18: 25252
SCOTT, K. G., Rubidium-86 uptake by red blood cells, 18: 25074
SCOTT, R. M., Time-dose relationships in Hodgkin's disease, 18: 25251
SCOZZAFAVA, R., Solution of energy-dependent Boltzmann equation, 18: 26500
SCRIBNER, Virgil E., Fluid metering device, 18: 26998
SCURLOCK, R. G., Helium-4 vapor pressure scale, 18: 25349
SEARS, V. F., Q branch of infrared spectrum of solid H, 18: 25346
SEBESTIAN, Imrich, Isolation of carbide phase from Ti–W alloyed Cr–Ni steel, 18: 25289
SECREST, Don, Eigenfunctions of the electron spin operators, 18: 26211
SECRETAN, L. F., Thermal and temperature conductivity of porous sintered materials, 18: 25987 (NP-tr-1247)
SEDGWICK, R. D., Hydrogen formation in radiolysis of liquid ethanol, 18: 25589
SEDLACEK, F., Film dosimetry in a radiology department, 18: 25721
SEEBASS, Joachim, Energy loss of charged particles in piezoelectric crystals, 18: 26370
SEEGMILLER, David W., Alpha decay of Tb and Dy isotopes, 18: 26615
SEIBEL, Georges, X-ray analysis with β source, 18: 25768
SEIDLITZ, Lee, Beta decay of Σ^+ and Σ^- hyperons, 18: 26354
SEKIDO, Kenji, Line-broadening due to ionized impurity scattering in Ge, 18: 26112 (NP-14017)
SEKINE, Tatsuya, Separation of Eu and Am by solvent extraction, 18: 25622
SELECKI, Anatol, Thermostat with 0.0005° regulation accuracy, 18: 25750 (PAN-459/XVI)
SELIGER, H. H., Chemiluminescence of H_2O_2–NaOCl solutions, 18: 25371
SELIN, L. -E., Band spectrum of Th oxide, 18: 25407
SEMASHKO, N. N., Motion of individual charged particles in trap, 18: 26702 (AEC-tr-5589(p.637-77))
SEMENENKO, K. N., Reactions of Be and Al chloride etherates, 18: 25431
SEN, Amiya Kumar, Kelvin-Helmholtz instability in plasma, 18: 26794
SENBA, Kei, Bound states in full symmetry theory, 18: 26361
SERAFIN, Francis A., Spectra and quantum states of Eu β-diketone chelates, 18: 25462
SERDUKE, James Tychon, Improvements in acceleration of charged particles, 18: 26182
SEREBRENNIKOV, V. V., Reduction of anhydrous Y and rare earth sulfates, 18: 25427
SERIO, John C., Angular correlation of γ rays from In-111 nuclei imbedded in Ag, 18: 26085
SETTLE, Frank A., Determination of electron deficiency in Li alkyls, 18: 25452
SETZWEIN, A., Power reactors and their economics, 18: 26930
SEWELL, P. F. J., Jaundice after halothane and radiotherapy, 18: 25118
SEYFFERTH, L., Power manipulator for "hot cells", 18: 25644
SEYFFERTH, L., Safety system for power reactors, 18: 26936
SGOUTAS, Demetrois Spyridon, Synthesis of H^3-labeled linoleic acid, 18: 25077
SHA, Biakow, Integral equation with diffusion kernel. IV., 18: 26866
SHA, Binkow, Integral equation with transport kernel. I., 18: 26867
SHAFER, Janice B., Y†(1385 Mev): study of spin and parity, 18: 26340
SHAH, K. B., Energy of Schwarzschild exterior field, 18: 26395
SHAH, V. K., Zirconium production and importance, 18: 25898
SHAI, R., Multipole expansion in electrodynamics, 18: 26392
SHANTARIN, V. D., Diffusion of metals in liquid Fe, 18: 26010
SHAPIRO, G., Determination of spin and parity of hyperons, 18: 26343
SHAPKIN, V. V., Radiation from faintly luminous pulsed plasma, 18: 26743
SHARMA, H. D., Oxalato complexes of Np(IV), 18: 25392
SHAROBAIKO, V. I., Decrease in DNA level of tissue after irradiation of organism, 18: 25137
SHARP, Brooks Martin, Solvent extraction of monazite rare earth nitrates–HNO_3–H_2O–TBP, 18: 25624
SHATALOV, A. Ya., Anodic oxidation of V and Nb, 18: 25929
SHAW, Gordon L., Unitarity and form factors in production process $\pi + N \to \rho + N$, 18: 26348
SHAW, W. A., Bowing behavior of fuel elements of EGCR, 18: 26938
SHCHEBOLEV, V. T., Determination of number of neutrons emitted by source, 18: 26503
SHCHEDRIN, N. I., Various states of compression of plasma loop in Zh-O installation, 18: 26704 (AEC-tr-5589(p.689-708))
SHEDLOVSKY, J. P., Radionuclide productions in thick iron targets with 1- and 3-Bev protons, 18: 26583
SHEKUN, L. Ya., Electron paramagnetic resonance of Gd^{3+} in CaF_2, 18: 25416
SHEN, S. P., Nuclear problems in radiation shielding in space, 18: 26816
SHEPSTONE, B. J., Parameters for multi-target and multi-hit survival curves, 18: 25170
SHERK, P. M., Exploding wires under water, 18: 26754
SHERRARD, H., Wire chamber—computer system, 18: 25779 (CONF-182-15)
SHERRY, Howard S., Carbonate and bicarbonate complexes of Nd and Eu, 18: 25438
SHESTAKOV, B. I., Actinium–Be sources for industrial geophysical investigations, 18: 25873
SHEVGHENKO, I. T., Administration of roentgen–Ra therapy during operation, 18: 25240
SHEVTSOVA, Z. V., Natural resistance of irradiated animals to brucellosis vaccine, 18: 25096 (JPRS-24896)
SHEYTANOV, G., Period of maximum deviation of lymphocyte segment index in irradiated animals, 18: 25203
SHIDA, Shoji, Gamma-induced liquid-phase polymerization of acrylamide, 18: 25536 (AEC-tr-6372(p.613-16))
SHIDA, Shoji, Radiation-induced polymerization in liquid SO_2, 18: 25537 (AEC-tr-6372(p.617-25))
SHIDA, Shoji, Radiolysis of squalane ($C_{30}H_{62}$), 18: 25551
SHIDLOVSKY, I., DTA and thermogravimetric study of La, Pr, Nd, and Sm perchlorates, 18: 25396
SHIFFER, I. V., Radiation effects on liver regeneration in white mice, 18: 25122
SHIGEMATSU, Tomonichi, Beta-induced crosslinking reactions of polyester resin, 18: 25527 (AEC-tr-6372(p.533-8))
SHIGEMATSU, Tomonichi, Power fluctuations of Van de Graaff electron accelerator, 18: 26171 (AEC-tr-6372(p.511-20))
SHIGEMATSU, Tomonichi, Radiation-induced crosslinking of epoxy resins, 18: 25528 (AEC-tr-6372(p.539-46))
SHIGEMATSU, Tomonichi, 500-curie Co-60 facility, 18: 25526 (AEC-tr-6372(p.521-32))
SHIGI, T., Superconductivity in Np and Pu, 18: 26473
SHIMAZU, F., Radiation damage to methionine and its derivatives, 18: 25573
SHIMELEVICH, Yu. S., Actinium–Be sources for industrial geophysical investigations, 18: 25873
SHIN, Yong-moo, Photoprotons from C, 18: 26674
SHINGYONAI, Akira, Radiation-induced polymerization of vinyl acetate, 18: 25507 (AEC-tr-6372(p.379-85))
SHINOHARA, Kenichi, Beta-induced crosslinking reactions of polyester resin, 18: 25527 (AEC-tr-6372(p.533-8))
SHINOHARA, Kenichi, Capture domains for stable radicals from polyethylene, 18: 25532 (AEC-tr-6372(p.577-86))
SHINOHARA, Kenichi, Crystal state and ESR of polyethylene, 18: 25529 (AEC-tr-6372(p.547-54))
SHINOHARA, Kenichi, ESR spectra of irradiated polytetrafluoroethylene, 18: 25530 (AEC-tr-6372(p.555-62))
SHINOHARA, Kenichi, ESR spectra and physical state of alkyl-type radicals from polyethylene, 18: 25533 (AEC-tr-6372(p.587-92))
SHINOHARA, Kenichi, Power fluctuations of Van de Graaff electron accelerator, 18: 26171 (AEC-tr-6372(p.511-20))
SHINOHARA, Kenichi, Radiation-induced crosslinking of epoxy resins, 18: 25528 (AEC-tr-6372(p.539-46))
SHINOHARA, Kenichi, Radiation-activated radicals in polyvinyl fluoride, 18: 25531 (AEC-tr-6372(p.563-74))
SHINOHARA, Kenichi, Summary research report of Tokyo laboratory, 18: 25525 (AEC-tr-6372(p.503-10))
SHINOHARA, Kenichi, 500-curie Co-60 facility, 18: 25526 (AEC-tr-6372(p.521-32))

SHINOZAKI, Yuichi, Autoxidation of unsaturated fatty acids irradiated with x rays, 18: 25570
SHIOJI, Yuji, ESR of acrylic acid radical, 18: 25518 (AEC-tr-6372 (p.465-71))
SHIOJI, Yuji, Radiation-induced polymerization of acrylic acid, 18: 25519 (AEC-tr-6372(p.473-80))
SHIOTA, Tetsunari, Reactions of irradiated polymer with Cl_2–SO_2, 18: 25490 (AEC-tr-6372(p.197-205))
SHIPMAN, W. D., Economic implications of nuclear power generation in large central stations, 18: 26993
SHIPP, Joseph C., Buffer distribution in isolated perfused rat heart, 18: 25041
SHOHNO, Naomi, Bound states in full symmetry theory, 18: 26361
SHONO, Yoshihiko, ESR of l-cysteine and l-cystine, 18: 25539
SHORT, E. L., Extraction of some metal bromides by TBP, 18: 25382
SHUL'MAN, A. R., Distribution of electron beam energy losses, 18: 26822
SHUL'MAN, A. R., Electrons transmitted by unsupported metal films, 18: 26821
SHURYGIN, P. M., Diffusion of metals in liquid Fe, 18: 26010
SHUSTER, Robert C., Dark repair of ultra-violet injury in *E. coli*, 18: 25221
SHUSTROV, V. A., Nonequilibrium evaporation of Ta, 18: 26015
SHVACHUNOV, I. N., Movement of charged particles in field of magnetic dipole, 18: 26128
SHVEIKIN, G. P., Phase components of Ta–C systems, 18: 26000
SICHA, Vladimir, Condition of rats with radiation injury of jaw, 18: 25199
SIDEBOTTOM, William Joseph, Device for shutting down of nuclear reactors, 18: 26858
SIDEROWITZ, Joshua, Ionization due to very soft sea level radiation, 18: 26102
SIEGBAHN, K., Electron spectroscopy for chemical analyses, 18: 25303
SIEGEL, S., Structural studies on Li_4UO_5 and Na_4UO_5, 18: 25388
SIEGFRIED, W., Metals subjected to stress and irradiation, 18: 25974 (EURAEC-1037)
SIGODINA, A. B., Kinetics of ion exchange on sulfocations, 18: 25422
SIL'CHENKO, V. V., Dimensions of leaf tissue nuclei after irradiation, 18: 25136
SILIN, V. P., Fluctuations in plasma, 18: 26707 (AEC-tr-5589(p.831-60))
SILIN, V. P., Kinetic theory of plasma wave interaction, 18: 26766
SILIN, V. P., Transport in nonisothermal ionized plasma, 18: 26769
SILIN, Yu. S., Determination of number of neutrons emitted by source, 18: 26503
SILKER, Wyatt B., Nuclear reactor operation, 18: 26861
SIMENOG, I. V., Collective excitations in nuclear matter, 18: 26612
SIMON, Norman, Safe procedures in radiation, 18: 25241
SIMONESCU, T., Extraction of Zr–alizarin S complex with butanol, 18: 25306
SIMONOF, G. S., Multiparameter pulse-height recording system, 18: 25823 (NAS-NRC-Pub-1184(p.287-91))
SINGER, Joy R., Conference on quantum electronics, Berkeley 3/61, 18: 26435
SINGH, M., Incoherent scattering and polarization of elastic scattering of γ rays, 18: 26293
SINGH, M., Large-angle Rayleigh scattering of 662-kev γ rays, 18: 26291
SINGH, M., Rayleigh scattering of 662-kev γ rays from different elements, 18: 26292
SINGHAL, S. P., Precipitation of Ce(IV) and La, 18: 25351
SINITSYN, V. V., Triple-layer bolometers for measuring plasma energy losses, 18: 26780
SIRLIN, A., Models for interactions, 18: 26270 (BNL-837(p.266-74))
SITENKO, A. G., Collective excitations in nuclear matter, 18: 26612
SITTERSON, B. W., Clinical bone marrow scanning with radioisotopes, 18: 25238
SKLYAR, N. T., Scattering of 0.5- to 0.8-Mev neutrons, 18: 26571
SKOLNICK, Malcolm Harris, Pion exchange currents in deuteron photodisintegration, 18: 26375
SKORUPSKI, Andrzej, Problems of magnetogasdynamics. I., 18: 26807
SKURIDIN, G. A., Movement of charged particles in field of magnetic dipole, 18: 26128
SLATER, D. N., Extraction of some metal bromides by TBP, 18: 25382
SLATTERY, Gerard, Improvements in or relating to U alloys, 18: 25910
SLAUGHTER, G. G., Gamma spectra from neutron capture in isotopes of Sn, 18: 26540 (ORNL-3582(p.62-7))
SLAUGHTER, G. G., Parameters of low-energy resonances in W, 18: 26539 (ORNL-3582(p.58-60))
SLEZOV, V. V., Photoeffect in superconductor, 18: 26494
SLOBODRIAN, R. J., Existence of diprotons using reaction $He^3(d,t)He^3$, 18: 26533 (NP-13974)
SLUIS, K. L. Vander, Optical physics, 18: 26114 (ORNL-3582(p.36-7))
SMAL, Z., Decontamination of surfaces contaminated with radioactive isotopes, 18: 25724
SMIRNITSKAYA, G. V., Gas discharge ion source, 18: 25655
SMIRNOV, V. P., Propagation of EM waves in plasma along magnetic field, 18: 26699 (AEC-tr-5589(p.596-611))
SMIT, J. van R., Ion exchange on ammonium molybdophosphate. II., 18: 25378
SMITH, A., 21-Cm absorption profiles for expanding gas cloud, 18: 26194
SMITH, A. B., Nuclear cross section measurements, 18: 26559 (WASH-1047)
SMITH, A. C. H., Charge transfer between O atoms and O^+ and H^+ ions, 18: 25377
SMITH, C. W., Drop test of unbuffered ¼-size model HAPO-1B cask, 18: 25708 (HW-77962)
SMITH, C. W., Fission-product shipping cask, 18: 25707 (HW-65268(Rev.1))
SMITH, Craig Gary, One-dimensional plasma model, 18: 26800
SMITH, E. G., Jr., Fabrication of U and U-base alloy tubes and rods, 18: 25940 (BMI-X-294)
SMITH, F., Calculation of gas transport properties, 18: 26136
SMITH, Gerald A., Analysis of 1.0- to 1.4-Bev π-p enhancement, 18: 26346
SMITH, Lloyd, Proton synchrotron for 150- to 300-Bev range, 18: 26170 (UCRL-10869)
SMITH, M. F., Constitution diagram W–Ru, 18: 26045
SMITH, P. Kent, Lanthanide boride systems and properties. I and II., 18: 25319 (COO-1140-103)
SMITH, R. D., Experiment and theory in reactor physics, 18: 26827
SMITH, Raymond Calvin, Positive pion photoproduction using polarized x rays, 18: 26382
SMITH, Robert Arthur, Improvements in nuclear reactors, 18: 26849
SMITH, Robert W., Jr., X rays scattered by polytype-crystalline materials, 18: 26104 (BM-RI-6455)
SMITH, S. J., Excitation of the 2p state of H, 18: 26225
SMITH, William R., Computer program for spin-½ particles, 18: 26556 (ORNL-TM-875)
SMITH, Willy, Void fraction measurements in cavitating venturi, 18: 25663
SMITHERMAN, R. L., Uranium density of systems, 18: 25324 (K-1609)
SMOOT, A. O., Effects of x irradiation on DNA synthesis in mouse spleen, 18: 25186
SMUTZ, M., Complex formation in the $Nd(NO_3)_3$–TBP–H_2O system, 18: 25393
SMYSLOV, Yu. N., MHD boundary layer on plane, 18: 26787
SNIEGOSKI, Lorne T., Tritium-labeled compounds. XI., 18: 25459
SNYDER, H. A., Velocity of secondary flow in Taylor's stability problem, 18: 26139
SOBOL, N. V., Air circulation in operational areas of high-level γ installations, 18: 25718
SOBUE, Hiroshi, Radiation-induced copolymerization of vinyl-type compounds, 18: 25535 (AEC-tr-6372(p.603-12))
SODA, Toshio, Impurity in the hard-sphere Bose gas, 18: 26406
SOICHER, H., Effects of arctic nuclear explosions on satellite radio communication, 18: 26100
SOKALSKI, Zdzislow, Method of obtaining unknown jellies of Th^{4+}–PO_4^{3-}–H_2O systems, 18: 25415
SOKOLOV, N. D., Hydrogen bond during isotopic substitution in ice, 18: 25417
SOKOLOV, V. I., Young's modulus anomalies in rare earth ferromagnets, 18: 26006
SOKOLOVA, I. G., Phase transformations in V–Ta alloys, 18: 26055
SOKOLOVSKAYA, E. M., Phase transformations in V–Ta alloys, 18: 26055
SOLANAS, J., Study of environmental radioactivity in Venezuela, 18: 25689
SOLARZ, A. K., Psychological field studies on irradiated adult female beagles, 18: 25091 (UCD-472-109(p.49-52))
SOLBERG, R. A., Sensitivity of tobacco mosaic virus to fast electrons, 18: 25159
SOLDATENKOV, T. R., Charge development in spatially periodic magnetic

field, 18: 26705 (AEC-tr-5589(p.758-66))
SOLDATENKOV, T. R., Plasma interactions with h-f field, 18: 26775
SOLOV'EV, L. S., Steady-state axially symmetric flow of plasma across azimuthal field, 18: 26773
SOLTIS, Paul J., Size effect in fine Be wire, 18: 25975 (NAEC-AML-1909)
SOMMER, J., Determination of Pu in urine, 18: 25299
SOOD, B. S., Incoherent scattering and polarization of elastic scattering of γ rays, 18: 26293
SOOD, B. S., Large-angle Rayleigh scattering of 662-kev γ rays, 18: 26291
SOOD, B. S., Rayleigh scattering of 662-kev γ rays from different elements, 18: 26292
SORANTIN, H., Analysis of nuclear fuel. I., 18: 25610 (SGAE-CH-4/1964)
SORANTIN, H., Analysis of nuclear fuel elements. I., 18: 26903
SORIANO, J., Praseodymium(IV) nitrate, 18: 25353
SOSI, Saudo, Introduction into portal vein of new colloidal complex labeled with P-32, 18: 25075
SOTNICHENKO, A. L., Torsion creep in Ti–Zr alloy, 18: 26011
SOUCH, Elizabeth Mary, Manufacture of neutron-absorbing materials, 18: 25958
SOULIOTIS, A. G., Determination of Ni in hydrogenated fats, 18: 25282
SOWBY, F. D., Effects of diagnostic irradiation, 18: 25151
SOWDEN, R. G., Gold as heat dispersant in exothermic solid-gas reactions, 18: 25420
SPANO, A. H., Analysis of Doppler-limited power excursions, 18: 26868
SPARBER, F. J., Electrical connector grounding apparatus, 18: 26996
SPARROW, E. M., Hydrodynamic entrance region of tubes and ducts, 18: 25668
SPENCER, James R., Buffer distribution in isolated perfused rat heart, 18: 25041
SPEROS, D. M., Emission of electrons from solids in gas discharges, 18: 26164
SPINDLER, Harald, Aluminum–Si materials with good corrosion stability, 18: 25931
SPINELLI, F., Submarine hulls for nuclear-powered tanker, 18: 26959 (RTI/ING(63)-4)
SPITZIG, W. A., Effects of sintering on the physical and mechanical properties of arc plasma-sprayed W, 18: 26046
SPITZIN, V. I., Electrochemical behavior of radioactive Fe and steel samples, 18: 25553
SRIVASTAVA, R. S., Toya's electron-phonon interaction and lattice vibrations of K, 18: 26142
STAATS, P. A., Optical physics, 18: 26114 (ORNL-3582(p.36-7))
STABLER, Robert C., Self-confinement of plasmas, 18: 26758
STAEUDNER, R., Semiconductor detector, 18: 25836
STAFFORD, David Francis, Thermionic Schottky deviations for W, 18: 26161
STAGG, William Roy, Formation constants of rare-earth complexes, 18: 25260
STAKHANOV, I. P., Transport equations for three-component plasma, 18: 26771
STANNARD, F. R., Trapping of Λ hyperons in nuclear matter, 18: 26623
STARFELT, N., Calculation of neutron capture γ-ray spectra, 18: 26611
STARKMAN, E. S., Expansion of low-quality two-phase fluid, 18: 25662
STARLING, P. P., Solving profile equation of a normal beam, 18: 26172
STARODUBTSEV, S. V., Effects of γ radiation on optical properties of synthetic ruby, 18: 26078
STAROSTINA, L. S., Electric conductivity of Mo monocrystals, 18: 26007
STARTSEV, V. E., Electric conductivity of Mo monocrystals, 18: 26007
STAUB, H. H., Threshold energy of the T(p,n)He³ reaction, 18: 26616
STAUDE, A., Upper limits for anomalous interactions of muon neutrinos, 18: 26321
STEBBINGS, R. F., Charge transfer between O atoms and O^+ and H^+ ions, 18: 25377
STEEN, D. A., Prog. rpt. on two-phase flow, 1–3/64, 18: 25657 (NYO-3114-1)
STEEN, Lennart, Observations on pigeons with prethalamic radiolesions, 18: 25099
STEHLIK, G., Early damage in cells after ionizing radiation. II., 18: 25085 (SGAE-BL-5/1964)
STEINBERG, M., DTA and thermogravimetric study of La, Pr, Nd, and Sm perchlorates, 18: 25396
STEINBERGER, J., Beta decay of Σ^+ and Σ^- hyperons, 18: 26354
STELSON, P. H., Coulomb excitation of vibrational triplet states and octupole states in even Cd nuclei, 18: 26551 (ORNL-3582(p.107-11))
STELSON, P. H., Coulomb excitation of Br-81 with α particles, 18: 26552 (ORNL-3582(p.112-14))
STEPANOV, A. S., Transport equations for three-component plasma, 18: 26771
STEPANOV, K. N., Passage of ion beams through plasma, 18: 26722
STEPANOV, V. G., Electron paramagnetic resonance of Gd^{3+} in CaF_2, 18: 25416
STERN, J. A., Instrumentation for determining Ar and He purity, 18: 25264 (CNLM-4016)
STERNGLASS, E. J., Planar dynode multipliers for high-speed counting, 18: 25739 (CONF-182-16)
STERTZER, Simon H., Effect of thorotrast on lymph and serum bilirubin levels, 18: 25060
STEVENS, D. J., Acute radiation injury (introduction to symposium), 18: 25144
STEWART, A. L., Fine structure of the P-2 terms of the Li isoelectronic sequence, 18: 26231
STEWART, A. L., $Z^{1/2}$ expansion of unrestricted Hartree-Fock wave functions, 18: 26230
STEWART, J. C. J., Photography of radioactive materials, 18: 26991
STICHEL, P., Photoproduction of pions in forward direction and Regge poles, 18: 26372
STICHEL, P., Pion production by linearly polarized photons, 18: 26276 (DESY-64/6)
STIENNON-BOVY, R., Iodine-132, 18: 25039 (BLG-44)
STIEVENART, M., Theory of exponential experiments with fast neutrons, 18: 26877
STOCKDALE, James Thomas, Process for effecting weld between the adjoining ends of two members lying side by side, 18: 25959
STOKELEY, James R., Liquid-liquid extraction of radio Sn, 18: 25274
STONE, Cecil C., Method and apparatus for sealing tubes, 18: 25961
STOPPINI, G., Two-body effective mass spectra in $\gamma + p \to p + \pi^+ + \pi^-$, 18: 26353
STORRER, F., Fast-neutron critical mockup, 18: 26875
STORRER, F., Theory of exponential experiments with fast neutrons, 18: 26877
STOTLAND, M. A., Charge development in spatially periodic magnetic field, 18: 26705 (AEC-tr-5589(p.758-66))
STOYENKO, S. G., Chemical radiation installation, 18: 25601
STRANDBERG, O., Iron-59 absorption measurements by whole-body counting and fecal recovery, 18: 25072
STRAUSS, M., Information processing systems at Argonne, 18: 25744 (NAS-NRC-Pub-1184(p.38-9))
STREEVER, R. L., Resonances of Ga-69 and Ga-71 in Ga-substituted YIG, 18: 25413
STREHLOW, Roger A., Reactive gas Mach stems, 18: 26137
STRELIN, G. S., Radiation effects on liver regeneration in white mice, 18: 25122
STRELOW, F. W. E., Separation of Sc from Y, La, and the rare earths, 18: 25613
STRICKLAND, Benjamin A., Jr., Current objectives in bioastronautics and aerospace medicine, 18: 25044
STRINGER, T. E., Electrostatic instabilities in plasmas, 18: 26732
STRZYZEWSKA, Bozena, Determination of La, Nd, and Pr, 18: 25288
STUKOV, G. M., Determination of number of neutrons emitted by source, 18: 26503
STUKOV, G. M., Efficiency of neutron sources by Au-foil activation method, 18: 26505
SUDARSHAN, E. C. G., Symmetries among the strong interactions, 18: 26327
SUDDATH, J. C., Conversion of radioactive liquid wastes to solids, 18: 26978 (ORNL-TM-857)
SUESS, H. E., Cosmic abundances of the elements, 18: 26201
SUGAWARA, Hirotaka, Triangle relation for nonleptonic hyperon decay amplitudes, 18: 26359
SUGAWARA, Ken F., Determination of Zr, Ti, and Mo in W, 18: 25281
SUGIMOTO, Ken'ichi, Formation of S compounds in radiolysis of S solutions, 18: 25548
SUGIMOTO, Ken'ichi, Formation of S compounds in radiolysis of toluene

solution of S, 18: 25547
SUGIMOTO, Ken'ichi, Radiation-induced reaction of benzyl mercaptan and *p*-tolyl mercaptan, 18: 25549
SUGIMOTO, Ken'ichi, Radiation-induced addition of H sulfide to propylene, 18: 25550
SUGIMOTO, Shunichi, ESR spectra of irradiated polyethylene, 18: 25512 (AEC-tr-6372(p.421-30))
SUITA, Tokuo, ESR of irradiated L-cystine dihydrochloride, 18: 25565
SUKHORUCHKIN, S. I., Interference effects in fission cross sections, 18: 26569
SUMIN, L. V., Measurements of kinetic energy of fragment ions, 18: 25763
SUN, C. R., Capture rate for muons in He-4, 18: 26524 (BNL-837(p.309-13))
SUNA, Andris, Green's function approach to exciton-phonon interactions, 18: 26424
SUNDBERG, O., Quasi-free p-p scattering in light nuclei, 18: 26567
SUNIER, J. W., Matrix elements of first-forbidden β transitions. I., 18: 26607
SURANYI, P., Pion-pion scattering amplitude, 18: 26326
SURGUTSKII, V. P., Reduction of anhydrous Y and rare earth sulfates, 18: 25427
SUSIC, M. V., Separation of U from some cations, 18: 25611 (AEC-tr-6227/1(p.1-8))
SUTTON, Doris C., Determination of Ce-144 in vegetation and soil, 18: 25265 (HASL-143)
SUZUKI, Keizo, Reaction of metallic W and F gas, 18: 25332 (UCRL-Trans-1044(L))
SUZUKI, Mahiko, Infinitesimal spontaneous mass splitting. I., 18: 26360
SVELTO, V., Current pulses released by Si surface-barrier detectors, 18: 25786 (NAS-NRC-Pub-1184(p.49-52))
SVELTO, V., Timing with semiconductor detectors, 18: 25787 (NAS-NRC-Pub-1184(p.53-8))
SVESHNIKOV, A. G., Motion of individual charged particles in trap, 18: 26702 (AEC-tr-5589(p.637-77))
SWALLOW, A. J., Trends in radiation chemistry, 18: 25540
SWEET, R. D., Treatment of over irradiated skin, 18: 25214 (AHSB(RP)R-39(p.87-93))
SYKES, E. C., Tensile properties of beta U, 18: 26031
SYRKUS, N. P., Chemical radiation installation, 18: 25601
SYROVOI, V. A., Equations for nonstationary charged particle beams, 18: 26147
SZABO, I., Dissociation of acetylene molecule ions, 18: 25336
SZANIAWSKI, Andrzej, Problems of magnetogasdynamics. I., 18: 26807
SZOSTAK, Roland, Angular correlations (p,p,γ) on Zn isotopes, 18: 26582
SZOTA, Piotr, Method of obtaining unknown jellies of Th^{4+}–PO_4^{3-}–H_2O systems, 18: 25415

T

TABAKOV, Iv., Urinary track radiography with Sr lactate contrast medium, 18: 25242
TABATA, Yoneho, Radiation-induced copolymerization of vinyl-type compounds, 18: 25535 (AEC-tr-6372(p.603-12))
TACHON, O., Uranium production plant at Le Bouchet, 18: 25899
TAI, Yuin Kwei, Counting efficiency of nuclear multiplate camera, 18: 25866
TAI, Yuin Kwei, Neutron total cross section of Pr at 14 Mev, 18: 26577
TAKABA, Y., Radiation injury in tissue culture, 18: 25117
TAKABAYASHI, Takeo, Radiation-induced graft polymerization on polyvinyl alcohol. XV., 18: 25482 (AEC-tr-6372(p.135-40))
TAKABAYASHI, Takeo, Radiation-induced graft polymerization of conjugated diene monomer, 18: 25484 (AEC-tr-6372(p.145-57))
TAKAC, S., Determination of D_2O–2% enriched U lattice parameters, 18: 26886
TAKAHASHI, Kiyoko, Spectrophotometric determination of rare earths, 18: 25285
TAKEMURA, Toyoko, Effects of γ rays on fried bean curd. IX., 18: 25138
TAKEZAKI, Junichi, Graft polymerization following pre-irradiation by $B^{10}(n,\alpha)Li^7$ reaction. II., 18: 25505 (AEC-tr-6372(p.363-9))
TAKEZAKI, Junichi, Graft polymerization following pre-irradiation in air by a $B^{10}(n,\alpha)Li^7$ reaction. III., 18: 25506 (AEC-tr-6372(p.371-7))
TAKEZAKI, Junichi, Radiation-induced telomerization of cyclohexene and acetaldehyde, 18: 25510 (AEC-tr-6372(p.405-12))
TALAAT, Mostafa E., Direct energy conversion, 18: 26255
TAMURA, Naoyuki, Crystal state and ESR of polyethylene, 18: 25529 (AEC-tr-6372(p.547-54))
TAMURA, Naoyuki, ESR spectra of irradiated polytetrafluoroethylene, 18: 25530 (AEC-tr-6372(p.555-62))
TAMURA, Naoyuki, Radiation-activated radicals in polyvinyl fluoride, 18: 25531 (AEC-tr-6372(p.563-74))
TAMURA, Taro, Scattering of 17.5-Mev protons by Ni-62, 18: 26536 (ORNL-3582(p.54))
TAMURA, Taro, Scattering of protons by Ho-165, 18: 26537 (ORNL-3582 (p.55))
TANAKA, Akiko, Effect of boric acid during heating or irradiation of polyvinyl alcohol, 18: 25487 (AEC-tr-6372(p.175-84))
TANAKA, Norimoto, Effect of x rays on secondary formation of gills in *Branchiura sowerbyi*, 18: 25135
TANAKA, S., Products formed by 2.9-Bev proton irradiation of Ag, 18: 26648
TANAKA, Shigetoshi, Microwave radiation at cyclotron harmonics in positive column, 18: 26691 (IPPJ-23)
TANAKA, Sho, Theory of weak interaction, 18: 26362
TANAKA, Yoshimasa, Behavior of unsaturated fatty acids in a γ-ray field, 18: 25591
TANEI, Tadayoshi, ESR of irradiated acrylamide, 18: 25517 (AEC-tr-6372(p.459-64))
TANEI, Tadayoshi, ESR of irradiated benzene, 18: 25520 (AEC-tr-6372 (p.481-90))
TANGHERLINI, F. R., Mass for a class of electron models in general relativity, 18: 26357
TANNER, Maurice Charles, Liquid-liquid contacting apparatus, 18: 25628
TAPPEL, A. L., Radiation damage to methionine and its derivatives, 18: 25573
TARASOV, N. D., Oxidation of Nb and its alloys, 18: 25936
TARASOV, N. D., Regularities in changing properties of Nb-based alloys, 18: 25999
TAS, A., Subcritical facility PUK, 18: 26878
TATU, V., Isotopic structure of the 5535 Å line of BaI, 18: 26213
TAU, L., Two-body effective mass spectra in $\gamma + p \to p + \pi^+ + \pi^-$, 18: 26353
TAVERNIER, G., Fast-neutron critical mockup, 18: 26875
TAYLOR, A., Refractory metal constitution diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
TAYLOR, Alan Frederick, Process for effecting weld between the adjoining ends of two members lying side by side, 18: 25959
TAYLOR, Geoffrey, Radioactivity in milk and bone, 18: 25727
TAYLOR, J. B., Equilibrium and stability of plasma in arbitrary mirror fields, 18: 26744
TAYLOR, J. B., Maximum plasma pressure for containment, 18: 26760
TAYLOR, J. M., Semiconductor particle detectors, 18: 25848
TAYLOR, John K., Determination of Zr in ZrO_2–$YO_{1.5}$, 18: 25277
TAYLOR, John Robert, Angular momentum of partial-wave amplitudes, 18: 26383
TAYLOR, R. E., Thermal properties of refractory materials, 18: 25986 (WADD-TR-60-581(Pt.IV))
TAZETDINOV, F. I., Vapor pressure of tritium oxide, 18: 25436
TELEGDI, V. L., Capture rate for muons in He-4, 18: 26524 (BNL-837 (p.309-13))
TELEGDI, Valentine L., Argonne-Chicago neutrino experiment at ZGS, 18: 26166 (BNL-837(p.170-89))
TELEGINA, I. V., Structure of pentaerythrite irradiated with x rays, 18: 26083
TELEGUS, V. S., Crystal structure of $Ta_3Ga_{1.5}$, 18: 26043
TELES PIMENTA, E. N., Utilization of Van de Graaff for industrial radiography, 18: 26175
TEL'KOVSKII, V. G., Measurement of energy of ions in trap with magnetic mirrors, 18: 26701 (AEC-tr-5589(p.626-36))
TEMCHIN, S. M., Charge development in spatially periodic magnetic field, 18: 26705 (AEC-tr-5589(p.758-66))
TEPLEY, Lee, Fine-structured hydromagnetic emissions, 18: 26448
TEPLITZ, V., Unitary spin assignment for the ω meson, 18: 26323
TERANISHI, Hiroshi, Pyrolysis of isopropyl iodide, 18: 25454
TER-MARTIROSYAN, K. A., High-energy behavior of elastic scattering

amplitude, 18: 26322
TEYSSIER, Jean-Louis, Distribution of photons and ions along a trajectory in Xe, 18: 26121
THATCHER, L. L., Tracer selection and tritium detection, 18: 25684 (TEI-839)
THIRIET, L., Economy of nuclear fuels, 18: 26904
THIRRING, Walter E., Solution of a field theoretical model, 18: 26390
THOMAS, G., Phase transformations in Nb, 18: 25992
THOMAS, J. K., Pulsed electron beam kinetics, 18: 25578
THOMAS, J. K., Radiation chemistry of single-C compounds and reactions of hydrated electron, 18: 25579
THOMAS, J. M., Kinetic anisotropy in oxidation of graphite, 18: 25932
THOMPSON, A., Reactions of Nb and Ta pentachlorides with sulfoxides, 18: 25398
THOMPSON, David Henry, Design for liquid-metal in-pile loop, 18: 25634
THOMPSON, Jane Cicely, Improvements in nuclear reactors, 18: 26839
THOMPSON, S. G., Energy-mass distributions in induced fission, 18: 26558 (UCRL-11377)
THOMPSON, W. B., Magnetohydrodynamics, 18: 26718
THOMPSON, W. E., Compartmentalization effects on dose rate in radiation field of reactor, 18: 25712 (USNRDL-TR-722)
THOMSON, J. O., Correlation of Mössbauer isomer shift with residual electrical resistance for Au alloys, 18: 26534 (ORNL-3582(p.16-17))
THOMSON, J. O., Hyperfine splitting in alloys of Fe–Rh, 18: 25982 (ORNL-3582(p.18-19))
THORN, James Douglas, Improvements in nuclear reactors, 18: 26891
THORNDIKE, E. H., Reduced energy spread of synchrocyclotron beams, 18: 26177
THORNETT, W. H., Apparatus for micro-scale liquid-liquid extractions, 18: 25609 (RCC-M-173)
TIBELL, G., Quasi-free p-p scattering in light nuclei, 18: 26567
TICHO, Harold K., Present status of Ξ decay, 18: 26275 (BNL-837(p.410-26))
TIENSUU, Victor H., X rays scattered by polytype-crystalline materials, 18: 26104 (BM-RI-6455)
TIGNER, Maury, Cornell counter-circulation storage ring, 18: 26158
TIGYI, Jozsef, Effect of 15-Mev electron rays on isolated frog heart, 18: 25098
TIKHINSKII, G. F., Beryllium and Cr whiskers, 18: 26009
TIKHINSKII, G. F., Tempering of Be–Ni alloys, 18: 26005
TIKHONOV, A. N., Motion of individual charged particles in trap, 18: 26702 (AEC-tr-5589(p.637-77))
TILL, J. E., Hemopoietic colony-forming cells transplanted into irradiated mice, 18: 25189
TIMIN, Mitchell E., Transfer mechanism, 18: 26855
TIMMERHAUS, K. D., Advances in cryogenic engineering. IX. Conference, Boulder, Colo., 8/63, 18: 26460
TIMNICK, Andrew, Polarographic behavior of Dy(III) in aqueous solutions, 18: 25333
TINKHAM, M., Angular dependence of the superconducting nucleation field, 18: 26479
TINKHAM, Michael, Group theory and quantum mechanics, 18: 26438
TITTERTON, E. W., Aspects of acute whole-body radiation exposure, 18: 25145
TITZE, H., Analysis of nuclear fuel. I., 18: 25610 (SGAE-CH-4/1964)
TITZE, H., Analysis of nuclear fuel elements. I., 18: 26903
TJIO, J. H., *In vivo* effects of diagnostic x irradiation on human chromosomes, 18: 25163
TKACHEV, V. D., Energy levels in electron-irradiated Si, 18: 26089
TODD, L., Trans-Alfvenic normal shock in a gas, 18: 26122
TODOROVIC, J., Spin fluctuation scattering of neutrons on pyrrhotite, 18: 26498 (PAN-280)
TOI, Yoshio, Polymerization of acrolein initiated by γ rays, 18: 25546
TOKATLY, V. I., Streamline flow of conducting compressible fluid, 18: 26774
TOKUDA, A., Radiation injury in tissue culture, 18: 25117
TOKUNAGA, Tsujihiko, Histopathological findings in radiation cataract, 18: 25195
TOLSTOI, M. N., Thulium luminescence in fluorite, 18: 25571
TOMCHUK, E., Isotope shift in Ba, 18: 26575
TOMONAGA, Masanobu, Leukemia in people exposed to atomic explosions, 18: 25728
TOPTYGIN, I. N., Theory of positron annihilation in ionized gas, 18: 26789
TORGOVITSKII, D. M., Chemical radiation installation, 18: 25601
TORIELLI, E., Design of boilers for power plants with GCR, 18: 26941
TOTH, Louis E., Stress field pinning in hard superconductors, 18: 26469
TOTH, Sandor, Selecting mass spectrometer, 18: 25772
TOTSKII, I. A., Scattering of 0.5- to 0.8-Mev neutrons, 18: 26571
TOTSKII, I. A., Scattering of 0.5- and 0.8-Mev neutrons, 18: 26568
TOUCHARD, J., Decay of the $f_{7/2}$ in Pb-207, 18: 26603
TREGEAR, R. T., Skin permeability and radioactive contamination, 18: 25056 (AHSB(RP)R-39(p.79-86))
TRENDELENBURG, E. A., Ultrahigh vacuum, 18: 25683
TRENTA, A., Changes of DNA of guinea pigs subjected to x irradiation, 18: 25102
TREUHERZ, Werner, Improvements in pliable sheeting for sound proofing and other purposes, 18: 25909
TRIBUKAIT, Bernard, Effect of uv radiation on erythropoiesis, 18: 25160
TRIMBLE, G. D., Neutron thermalization in Zr hydride, 18: 26514
TROCHERIS, M., Marginal stability condition for stationary non-dissipative motions, 18: 26738
TRODDEN, W. G., Activation of thoria-coated filament emitters, 18: 25752
TROITSKII, O. A., Effect of irradiation on deformation of Zn single crystals, 18: 26090
TROUT, E. Dale, Leakage radiation through lead glass, 18: 25249
TRUBY, Frank K., Ionic species in γ-irradiated amyl disulfide, 18: 25557
TRUEMAN, T. L., Restrictions imposed by optical theorem on exchanged quantum numbers, 18: 26337
TSEREVITINOV, S. S., Compression of plasma by rapidly increasing magnetic field, 18: 26698 (AEC-tr-5589(p.565-84))
TSING, Poh-hua, Mössbauer absorption line spectrum of ferrous gluconate and anhydrated ferrous sulfate, 18: 25347
TSINTSADZE, N. L., Theory of interaction of waves in plasma, 18: 26723
TSOCHEV, Ts. N., Protection against acute radiation sickness by organolysates, 18: 25219
TSUNETO, Toshihiko, Superflow of He II through narrow channels, 18: 26492
TSYGANKOVA, L. E., Anodic oxidation of V and Nb, 18: 25929
TUAN, S. F., Meson-baryon systems and their resonances, 18: 26332
TUCKER, Philip A., Preparation of Pu-bearing oxide particulates, 18: 26008
TUFFIN, Wilson B., Metallurgical bonding of dissimilar metals by co-extrusion, 18: 25953
TUMANOV, V. I., Strength and decomposition of solid solutions of WC–Co, 18: 26004
TUNG, Tsi-chien, EPR spectrograph with frequency and magnetic field modulation, 18: 25762
TUNITSKII, N. N., Effect of Co-60 γ radiation on alkaline anion-exchange resins, 18: 25541
TUNITSKII, N. N., Kinetics of ion exchange on sulfocations, 18: 25422
TUNITSKII, N. N., Measurements of kinetic energy of fragment ions, 18: 25763
TURKIEWICZ, J., Energy spectrum of α particles from $La^{139}(n,\alpha)Cs^{136}$ reaction at 14.1 Mev, 18: 26606
TURKIEWICZ, Jan., Mechanism of tripartition, 18: 26557 (PAN-481/I)
TURKOT, F., Lifetime of K_2^0 mesons, 18: 26261 (BNL-837(p.42-52))
TURLAY, R., K_1-K_2 mass difference, 18: 26263 (BNL-837(p.74-81))
TURNER, J. M., Prog. rpt. on two-phase flow, 1–3/64, 18: 25657 (NYO-3114-1)
TURNER, W. Richard, Graphite-indicating electrodes, 18: 25320 (COO-1148-84)
TUROVA, N. Ya., Reactions of Be and Al chloride etherates, 18: 25431
TURSKI, Andrzej, Problems of magnetogasdynamics. I., 18: 26807
TUSTING, R. F., Light flash generator for gain stabilization of photosensitive systems, 18: 25817 (NAS-NRC-Pub-1184(p.220-8))
TWIN, P. J., Energy levels of Cr-50, 18: 26619
TYKVA, R., C-14 radioactive measurements of organic substances, 18: 25293
TYLER, A. R., Suppression of edge effects in superconducting films, 18: 26482
TYZACK, C., Behavior of materials in liquid Na, 18: 25937

U

UFER, I. D., Economical size of nuclear power stations. I., 18: 26934
UHLMANN, W., Bibliography on radiation effects on solid, U-based nuclear fuel materials, 18: 26072 (VDDIT-16(4.2))
UHRIG, Robert E., Power-spectral density measurements in a subcritical nuclear reactor, 18: 26970
UKKESTAD, A., Void effects in zero-power critical facility NORA, 18: 26884
ULLMANN, J. W., Dissolution of ThO–UO_2 fuel particles in HNO_3–HF solutions, 18: 25608 (ORNL-TM-867)
ULRICH, H., Silicon photocells for high γ dose-rate measurements, 18: 25833
UL'YANOV, R. A., Oxidation of Nb and its alloys, 18: 25936
UL'YANOV, R. A., Regularities in changing properties of Nb-based alloys, 18: 25999
UMEZAWA, Masao, Graft polymerization following pre-irradiation by $B^{10}(n,\alpha)Li^7$ reaction. II., 18: 25505 (AEC-tr-6372(p.363-9))
UMEZAWA, Masao, Graft polymerization following pre-irradiation in air by a $B^{10}(n,\alpha)Li^7$ reaction. III., 18: 25506 (AEC-tr-6372(p.371-7))
UNDERWOOD, Robin Arthur, Improvements in nuclear reactor fuel loading arrangements, 18: 26846
URAKAMI, Chieko, Effects of γ rays on fried bean curd. IX., 18: 25138
URIANO, G. A., Resonances of Ga-69 and Ga-71 in Ga-substituted YIG, 18: 25413
URUBAY, S., Ion exchange in non-aqueous solvents, 18: 25305
UTZINGER, E., MINOR—subcritical facility for heavy-water lattice studies, 18: 26882

V

VAJDA, F., Design of nuclear electronic devices, 18: 25832
VAKHNIN, V. M., Movement of charged particles in field of magnetic dipole, 18: 26128
VAL'DSHTEYN, E. A., Oxygen effect and post-radiation reparation after action of x-rays on bacterial cell, 18: 25229
VALENTIN, Andre, Magnetically controlled fluid-tight conveying apparatus, 18: 25653
VALLAURI, M., Digital position indicator for control rods, 18: 26834
VAN ALLEN, J. A., Earth's outer radiation zone, 18: 26444
VAN ALLEN, J. A., Starfish and Soviet artificial radiation belts, 18: 26188 (SUI-63-37)
VAN BOUWDYK BASTIAANSE, M. A., Operation for a large Ra fistula, 18: 25232
VANDENBOSCH, R., Formation of Cs-134m and Cs-134, 18: 26585
VAN DEN BRANDE, J., Gamma effects on farina moth, 18: 25125
VANDENBURGH, Frank, Casting W and W–Mo alloys, 18: 25954
VAN DIEVOET, J., Fast-neutron critical mockup, 18: 26875
VAN HOVE, L., Basic SU(3) triplets, 18: 26324
VAN KAMPEN, N. G., Field correlation functions in plasma, 18: 26750
VAN KRANENDONK, J., Q branch of infrared spectrum of solid H, 18: 25346
VAN LANCKER, J. L., Effects of x irradiation on DNA synthesis in mouse spleen, 18: 25186
VAN RIET, R., Rotation spectra of $S^{32}O^{16}O^{18}$ and $S^{32}O^{18}O^{18}$ in the (0,1,0) state, 18: 25334
VAN RIET, R., Rotation spectra of $S^{32}O^{16}O^{18}$ in the (0,0,0) state, 18: 25335
VAN RINSVELT, H. A., Spin and parity of the 3.13-Mev level in P-31, 18: 26635
VAN TORNE, L. I., Phase transformations in Nb, 18: 25992
VAN VAERENBERGH, P. M., Problems posed by patient with enlarged thyroid, 18: 25237
VASIL'EV, V. I., Compression of plasma by rapidly increasing magnetic field, 18: 26698 (AEC-tr-5589(p.565-84))
VASUDEVAN, Ramabhadra, Invariant imbedding theory of neutron transport, 18: 26508
VASYUTINSKII, B. M., Beryllium and Cr whiskers, 18: 26009
VAVILOV, V. S., Energy levels in electron-irradiated Si, 18: 26089
VAYNSHTEYN, B. I., Chemical radiation installation, 18: 25601
VEBERSIK, V., Intraperitoneal application of Au-198, 18: 25071
VEDENOV, A. A., Shock waves in dilute plasma, 18: 26697 (AEC-tr-5589 (p.554-64))
VEKSLER, V. I., Bombardment of Mo with positive Cs ions, 18: 26233
VELICHKO, A. A., Absolute age in Loess soils of Russian Steppe, 18: 25685
VELIKHOV, E. P., Shock waves in dilute plasma, 18: 26697 (AEC-tr-5589 (p.554-64))
VELTMAN, M., CERN neutrino experiment, 18: 26266 (BNL-837(p.160-9))
VENDRYES, G., Fast-neutron critical mockup, 18: 26875
VENIKOV, N. I., Calculating focusing system of two quadrupole magnets, 18: 26178
VENKATESAN, K., Note on use of Wick's theorem, 18: 26398
VENTER, R. H., Model for elastic nuclear scattering and polarization of spin-½ particles. II., 18: 26562
VENTER, R. H., Model for elastic nuclear scattering and polarization of spin-½ particles. III., 18: 26563
VERGHESE, Mattackal Koruvilla, Annealing of radiation-induced defects in Bi, 18: 26094
VERMA, G. S., Electronic thermal conductivity of superconductors, 18: 26486
VERSTER, J. L., Use of gauzes in electron optics, 18: 26129
VERTES, M., Uranium refining techniques, 18: 25616
VESELINOVIC, D. S., Separation of U from some cations, 18: 25611 (AEC-tr-6227/1(p.1-8))
VIETZKE, H., Conversion of UF_6 to UO_2, 18: 25402
VIGILEVA, E. S., Lanthanum tellurides, 18: 25430
VINCENT, Germain, Wave guide for electron linac, 18: 26183
VINOKUROV, V. M., Electron paramagnetic resonance of Gd^{3+} in CaF_2, 18: 25416
VISSERS, D., Properties of Zr and Hf peroxy compound, 18: 25379
VLADIMIROV, V. G., Decrease in DNA level of tissue after irradiation of organism, 18: 25137
VLADIMIROVA, M. V., Alpha radiolysis of aqueous solutions, 18: 25590
VLASYUK, P. A., Dimensions of leaf tissue nuclei after irradiation, 18: 25136
VOHR, J. H., Spiral-grooved, self-acting, gas bearing, 18: 25640 (TID-20632)
VOIDA, G., Inspectable soldering flux composition, 18: 27001
VOLKENSHTEIN, N. V., Electric conductivity of Mo monocrystals, 18: 26007
VOLOKHONSKAYA, M. L., Semicarbazide-Cd therapy in patients suffering from malignant neoplasms, 18: 25054
VON ESSEN, Carl F., Sequelae of radical radiotherapy of lung carcinoma, 18: 25252
VON ROOS, Oldwig, Interaction of very intense radiation fields with atomic systems, 18: 26423
VORONKO, N. D., Semicarbazide-Cd therapy in patients suffering from malignant neoplasms, 18: 25054
VORRES, Karl S., Rare earth oxyfluorides, 18: 25318 (CONF-405-39)
VOSHAGE, H., Radiation ages of some Fe meteorites, 18: 26198
VOSKRESENSKII, G. V., Radiation from point charged particle in flight, 18: 26150
VOSS, R. G. P., Heavy liquid bubble chamber in CERN neutrino experiment, 18: 26265 (BNL-837(p.114-36))
VOUTILAINEN, A., Effect of x rays on mitotic activity in organs of rats, 18: 25101
VRUBLEVSKAIA, N. A., Broadening and shift of Al(III) spectral lines in strongly ionized plasma, 18: 26710 (AEC-tr-6227/1(p.15-24))
VYSHESLAVTSEV, S. I., Semicarbazide-Cd therapy in patients suffering from malignant neoplasms, 18: 25054

W

WACKER, Adolf, Radiochemical change of halogen–uracil in DNA, 18: 25593
WADE, R. D., Solution of two-dimensional axially symmetric multigroup stationary neutron transport equation, 18: 26497 (AWRE-O-66/63)
WADHWA, R. P., Space-charge neutralization in electron-ion systems, 18: 25646
WADSWORTH, M. E., Oxidation kinetics of Ta in CO_2, 18: 25935
WAENKE, H., Rare gases in stone meteorites, 18: 26197
WAGENER, H.-H., Immediate detection of biological effects of x rays, 18: 25134
WAGHMARE, Yeshwant R., Nucleon-nucleon potential in similar configura-

tions, 18: 26638
VAHLBERG, J. S., Adsorption equilibria between earth materials and radionuclides, Cape Thompson, Alaska, 18: 25688 (TID-20638)
VAINE, Peter, Improvements in reactor fuel elements, 18: 26909
VAINE, Peter, Improvements in fuel elements for reactors, 18: 26912
VAINWRIGHT, C., Structures of Nb–H systems, 18: 26024
VAINWRIGHT, T., Calculation of hard-sphere viscosity, 18: 25362
VALDEN, G. E., X-ray fluorescence tables: LiF crystal, 18: 25330 (Y-1470-C)
VALDEN, G. E., X-ray fluorescence tables: EDDT crystal, 18: 25449 (Y-1470-D)
VALDNER, F., Nuclear magnetic resonance of La-139 and Al-27 in La aluminate, 18: 26625
VALDRAM, J. R., Surface impedance of superconductors, 18: 26467
VALECKA, J. D., Electrodynamic processes with nuclear targets, 18: 26564
VALKER, P. A., Suppression of edge effects in superconducting films, 18: 26482
VALKER, R., Capture rate for muons in He-4, 18: 26524 (BNL-837(p.309-13))
VALKER, Ray R., Improved W electrodes, 18: 25918
VALLACE, A. T., Sensitivity of castorbean to γ rays, 18: 25180
VALLACE, Alvin T., Gamma-induced mutation rates in oats, 18: 25181
VALLIS, G. B., Prog. rpt. on two-phase flow, 1–3/64, 18: 25657 (NYO-3114-1)
VALLWORK, F. E., Lithium tetraborate, 18: 25331 (AWRE-Trans-43)
VALT, M., Small-angle elastic scattering of neutrons, 18: 26519
VALTER, F. J., Fission of oriented nuclei, 18: 26554 (ORNL-3582 (p.121-6))
VALTON, D. G., Reactor physics research at Victoria University, 18: 26828
VANG, Shou-yu, Mössbauer absorption line spectrum of ferrous gluconate and anhydrated ferrous sulfate, 18: 25347
VANIC, A., Spin fluctuation scattering of neutrons on pyrrhotite, 18: 26498 (PAN-280)
VAPSTRA, A. H., Decay of the $f_{7/2}$ in Pb-207, 18: 26603
VARHANEK, H., Formation of Cs-134m and Cs-134, 18: 26585
VARZEE, M., Corrosion of C and stainless steels in water and steam. I., 18: 25922 (EURAEC-1038)
VASILEWSKI, Michael, Complications in treatment of urinary bladder cancer, 18: 25244
VASSEF, S., Thorotrast-induced cholangioma, 18: 25147
VASSERMAN, Allen Lowell, Hydrogen molecule-ion, 18: 26162
VASSON, John T., Radioactivity in Sputnik-4 fragment, 18: 26127
VATABE, Mitsuo, Potential of an interacting electron-phonon system, 18: 26143
VATANABE, Haruhiko, Radiation-induced polymerization of oxetane derivatives, 18: 25497 (AEC-tr-6372(p.273-86))
VATANABE, Tsunao, Complex formation of B fluoride with lower olefins at low temperatures. II., 18: 25341
VATERS, James Duncan, Improvements in fuel elements for reactors, 18: 26912
VATKINS, M. T., New trends in metal working, 18: 25955
VATY, J., Corrosion of C and stainless steels in water and steam. I., 18: 25922 (EURAEC-1038)
VAWRA, H., Absolute intensity of diffuse x-ray small-angle scattering, 18: 25838
VAWRZYCZEK, Wiktor, Titrometric determination of trivalent Ce ions, 18: 25287
VEALE, J. W., Zero-energy fast reactor VERA, 18: 26876
VEAVER, Harry E., Superconducting magnets, 18: 26478
VEAVER, Lynn E., Prog. rpt. on improvement of BWR stability, 1–4/64, 18: 26924 (EURAEC-1065)
VEBB, V. H., Helium-3-induced charged-particle reactions, 18: 26549 (ORNL-3582(p.100-1))
VEBER, Jon N., Variations of O-18/O-16 and C-13/C-12, 18: 25695
VEBER, T. A., Coulomb scattering of Dirac particles, 18: 26279
VEBER, T. A., Method of asymptotic expansion of Fourier-type integrals, 18: 26280
VEGENER, H. H. F., Hyperfine splitting in alloys of Fe–Rh, 18: 25982 (ORNL-3582(p.18-19))
WEIDENMUELLER, Hans A., Many-channel scattering, 18: 26283
WEIMAR, Ir. K. L. A., Time-of-flight spectrometer for thermal neutrons, 18: 25863
WEINBERG, Steven, Perturbation theory for strong repulsive potentials, 18: 26302
WEINGARTNER, Ernst, Preparation of graphite free from B, 18: 25915
WEINMAN, James Adolf, Plurally charged ion beam generation method, 18: 26186
WEIR, R. A., Solar-flare α particles, 18: 26445
WEISFELD, Morris, Relativistic mass-center problem, 18: 26397
WEISSGLAS, P., Absorption of waves in bounded low-density plasma, 18: 26731
WEKER, Peter, Improvements in hoses for cooling arrangements, 18: 25649
WELLER, C. A., Recent developments in multicompartment tracer analysis, 18: 25052
WELLER, P. F., Fluorescence in Y_2O_3: Eu^{3+}, 18: 25564
WELLS, Daniel R., Axially symmetric force-free plasmoids, 18: 26751
WELTON, T. A., Electron microscope for determination of molecular structure, 18: 25749 (ORNL-3582(p.40-1))
WELTON, T. A., Optical physics, 18: 26114 (ORNL-3582(p.36-7))
WELTON, T. A., Quantized space-time, 18: 26387 (ORNL-3582(p.41-5))
WENDENBURG, J., Radiolysis of dichlorobenzenes, 18: 25592
WENDT, Ernst, Influence of supercooling on irradiated cells, 18: 25204
WENG, Tu-Lung, Thermal stresses in anisotropic hollow cylinders, 18: 26116 (WADD-TR-61-72(Vol.XIX))
WENTWORTH, R. C., Hydromagnetic emissions after geomagnetic storms, 18: 26449
WERNBOM, E., Decays of F-17, Na-21, Al-25, and Al-26m, 18: 26565
WERNER, G. K., Optical physics, 18: 26114 (ORNL-3582(p.36-7))
WERNICK, J. H., Anisotropic hfs interactions in ferromagnets, 18: 26038
WERT, Charles, Diffusion of O and N between interstitial sites in Yb, 18: 26050
WERTHEIM, G. K., Anisotropic hfs interactions in ferromagnets, 18: 26038
WESS, J. E., Solution of a field theoretical model, 18: 26390
WESTGARD, J. B., Observation of reaction $\bar{p} + d \rightarrow \Lambda + \Sigma^- + \Xi^+$, 18: 26334
WHALEN, J. F., "On-line" operation of a digital computer, 18: 25888
WHEELER, Robert G., Cladding of nuclear fuel elements, 18: 25962
WHEELWRIGHT, E. J., Preparation of U(IV) fluoride salts from uranyl sulfate, 18: 25323 (HW-48782)
WHITE, Clayton S., Environmental effects at Hiroshima and Nagasaki, 18: 25722
WHITE, David, Heat capacities of solid D, 18: 25365
WHITE, J., New ceramics and refractories, 18: 26058
WHITEHEAD, J. D., Occurrence of sporadic-E, 18: 26440
WHITEMAN, K. J., Minimum-B plasma equilibria with finite pressure, 18: 26762
WHITNEY, J. B., Prog. rpt. on coatings for Nb alloys, 12/62–2/63, 18: 25896 (PF-63-3)
WICK, E. A., Fabrication of collapse clad for Pathfinder, 18: 26914 (ACNP-63031)
WIEDERHOLD, P. R., Fast-acting superconducting power switches, 18: 26493
WIESENER, Heinrich, Pharmacology and toxicology, 18: 25046
WIGGINS, John S., Linear semiconductor junction radiation detector, 18: 25858
WILDE, James H., Nuclear radiation glow tube indicator, 18: 25854
WILEY, Richard H., Gamma-induced decomposition of amides in CCl_4, 18: 25572
WILFONG, Roy L., Thermogravimetric analysis of five salts of Pr, Nd, and Sm, 18: 25354
WILHELMI, Z., Energy spectrum of α particles from $La^{139}(n,\alpha)Cs^{136}$ reaction at 14.1 Mev, 18: 26606
WILHITE, Richard N., n-Paraffin mixtures as diluent for TBP in radiochemical separations, 18: 25605 (DP-882)
WILKINS, N. J., Measurements on oxide films on Zr, 18: 25925
WILKINSON, D. H., Lifetimes of first excited states of O-17 and F-17, 18: 26641
WILLARD, H. B., Alpha-alpha correlations in $Li^7 + d \rightarrow 2\alpha + n$, 18: 26548 (ORNL-3582(p.99))
WILLARD, H. B., Elastic scattering of α particles by O-18, 18: 26645

WILLARD, H. B., Proton bombardment of Li-6, Li-7, Be-9, B-11, and O-18, 18: 26601
WILLARD, John E., Reactions of hot H atoms. II., 18: 25561
WILLARD, John E., Reactions of hot H atoms. I., 18: 25560
WILLET, Robert R., Density determining apparatus, 18: 25773
WILLIAMS, G. L., Jaundice after halothane and radiotherapy, 18: 25119
WILLIAMS, Jack, Production of U–C alloys, 18: 25963
WILLIAMS, M. M. R., Pulse of slowing down neutrons, 18: 26513
WILLIAMS, Ronald Peter, Improvements relating to nuclear reactors, 18: 26890
WILLIAMSON, Grahame William, Thermocouples, 18: 25765
WILLIS, William Woodford, Development of liquid He scintillator, 18: 25849
WILLMOTT, J. C., Energy levels of Cr-50, 18: 26619
WILLS, John Gordon, Extended optical model, 18: 26678
WILMENIUS, P., Dissociation of acetylene molecule ions, 18: 25336
WILSON, Paul E., Linear bending analysis of pressurized multicell shell structure, 18: 25633 (ERR-AN-336)
WILSON, R., Trapping of Λ hyperons in nuclear matter, 18: 26623
WILSON, Robert John, Reactions (d,α) on Be-9, N-14, F-19, and P-31, 18: 26675
WILSON, Volney C., Thermionic power generation, 18: 26933
WINDSOR, Alfred A., D-c instrument transformer system, 18: 26997
WINKLER, C., Selective deposition of radioactivity in malignant tumors, 18: 25068
WINKLER, H., Threshold energy of the T(p,n)He^3 reaction, 18: 26616
WINSON, R. W., BOOMER—program for evaluating response of SNAP 2/10A, 18: 26957 (NAA-SR-8414)
WINSTON, R., Capture rate for muons in He-4, 18: 26524 (BNL-837 (p.309-13))
WINTER, Erwin, Radiochemical behavior of triphenyltetrazolium chloride, 18: 25595
WIPF, S. L., Superconducting d-c generator, 18: 26465
WITTE, S., Autologous bone marrow cell transfusion, 18: 25220
WIX, L. F. U., Discharge of waste from Windscale, 18: 25723
WOJCICKI, Stanley G., Search for Y_1^* resonances, 18: 26328
WOLFENSTEIN, Lincoln, Muon capture in complex nuclei, 18: 26523 (BNL-837(p.292-7))
WOLFRAM, B., Control of neutron flux at the high-temperature reactor BBC/KRUPP, 18: 26968
WOLFRAM, B., Neutron flux measurement, 18: 26967
WOLLAN, E. O., Alignment of rare earth moments in dilute Pd–Fe alloys, 18: 25977 (ORNL-3582(p.2-4))
WOLLAN, E. O., Antiferromagnetism of ordered Pd_3Cr, 18: 25978 (ORNL-3582(p.5-6))
WOLLAN, E. O., Magnetic properties of intra-rare-earth alloys, 18: 25980 (ORNL-3582(p.9-10))
WOLLAN, E. O., Magnetic structure properties of rare-earth alloys, 18: 25981 (ORNL-3582(p.11-16))
WOLLAN, E. O., Neutron-diffraction investigation of Cr alloys, 18: 25979 (ORNL-3582(p.7-8))
WOLSTENHOLME, Stanley, Improvements in pliable sheeting for sound proofing and other purposes, 18: 25909
WOOD, J. I., Void effects in zero-power critical facility NORA, 18: 26884
WOODS, L. C., Hydromagnetic waves in cylindrical plasma, 18: 26728
WOODY, J. W., Jr., Analyzer systems at ORNL, 18: 25745 (NAS-NRC-Pub-1184(p.40-1))
WORLEY, N. G., Reducing exhaust steam wetness in Magnox reactor systems, 18: 25660
WORSNOP, Ralph, Dose delivered to the mediastinum, 18: 25253
WORT, D. J. H., Microwave emissivity of turbulent plasma, 18: 26730
WRAY, E. M., Helium-4 vapor pressure scale, 18: 25349
WRAY, E. T., Conference on radiation and skin, AERE, Winfrith, 11/63, 18: 25037 (AHSB(RP)R-39)
WRIGHT, Wayne L., Grenz ray in treatment of acne vulgaris, 18: 25235
WU, Tai Tsun, Higher order leptonic weak interactions, 18: 26269 (BNL-837(p.257-65))
WU, Tai Tsun, Scattering formalism for singular potential theory, 18: 26415
WU, Tai Tsun, Singular potentials and peratization. II., 18: 26407
WYTTENBACH, A., Products formed by 2.9-Bev proton irradiation of Ag, 18: 26648

Y

YAFFE, L., Bombardment of Dy with protons at 9 to 87 Mev, 18: 26584
YAGOVOI, P. N., Total β activity of water and air areas of Pacific Ocean, 18: 25690
YAHATA, Tanoaki, Reaction of metallic W and F gas, 18: 25332 (UCRL-Trans-1044(L))
YAKOVENKO, G. M., Use of N-15 in investigating role of Cu in plant assimilation of ammonia and nitrate N, 18: 25059 (OTS-63-11008(p.6-14))
YAMAGUCHI, Kusuo, Radiation-induced thermoluminescence of polyethylene, 18: 25471 (AEC-tr-6372(p.49-59))
YAMAGUCHI, Kusuo, Radiation-induced thermoluminescence of benzene derivatives, 18: 25472 (AEC-tr-6372(p.61-74))
YAMAGUCHI, Kusuo, Radiation-induced thermoluminescence of trioxane and dioxane, 18: 25473 (AEC-tr-6372(p.75-82))
YAMAGUCHI, Y., Particle physics trio invariance, 18: 26325
YAMAKA, Eiso, Paramagnetic resonance of Fe group elements in rutile. I., 18: 25411
YAMAMOTO, Masao, Radiation-induced polymerization of ethylene, 18: 25508 (AEC-tr-6372(p.387-95))
YAMAMOTO, Osamu, Fast-neutron absorption dose estimation, 18: 25048
YAMAOKA, Nishi, Radiation-induced polymerization of formaldehyde. III., 18: 25492 (AEC-tr-6372(p.213-22))
YAMASAKI, Hisaiti, Position operator of Dirac electron. I., 18: 26363
YAMASAKI, Hisaiti, Position operator of Dirac electron. II., 18: 26364
YAMAZAKI, Hideo, Radiolysis of squalane ($C_{30}H_{62}$), 18: 25551
YANG, C. N., Theoretical considerations concerning neutrino experiments, 18: 26268 (BNL-837(p.249-56))
YANG, Won-Jei, Transient heat transfer in vapor-heated heat exchanger, 18: 25664
YANKUCHEVICH, V. A., Mechanism of creep of Zr, 18: 26002
YAREMBASH, E. I., Lanthanum tellurides, 18: 25430
YARITSYNA, I. A., Determination of number of neutrons emitted by source, 18: 26503
YARITSYNA, I. A., Efficiency of neutron sources by Au-foil activation method, 18: 26505
YARITSYNA, I. A., Measurement of efficiency of neutron sources, 18: 26504
YAROSHEVSKII, F. Yu., Semicarbazide-Cd therapy in patients suffering from malignant neoplasms, 18: 25054
YASHIN, N. M., Radiation from faintly luminous pulsed plasma, 18: 26743
YASUDA, Minoru, RF-type mouse leukemia induced by radiation, 18: 25226
YATES, M. J. L., Coulomb excitation of Se-76 and Se-78 using O ions, 18: 26610
YATSENKO, A. F., Luminescence of KNO_3 irradiated with γ rays, 18: 25586
YEE, W. C., Head-end treatments of Purex-1WW waste for fission-product recovery, 18: 25606 (ORNL-3585)
YEM, Phan Xuan, Nonlocal effects for Moeller and Bhabha scatterings, 18: 26289
YGUERABIDE, Juan, Diffusion-controlled processes in liquids, 18: 25562
YILDIZ, Muso, Electromagnetic radiation from uniformly moving dipoles. I., 18: 26396
YONEYAMA, Yoshimasa, Effects of total-body x irradiation on serum Fe of rabbits, 18: 25164
YOSHIDA, Hiroyuki, Lanthanides in $HClO_4$–TBP system, 18: 25381
YOSHIMINE, M., Beryllium oxide ground state, 18: 25364
YOSHIMURA, Ryugen, Gamma-induced liquid-phase polymerization of acrylamide, 18: 25536 (AEC-tr-6372(p.613-16))
YOSHIMURA, Ryugen, Radiation-induced polymerization in liquid SO_2, 18: 25537 (AEC-tr-6372(p.617-25))
YOSHINAGA, Haruma, Biological actions of 14.1-Mev fast neutrons, 18: 25165
YOSHINAGA, Haruma, Fast-neutron absorption dose estimation, 18: 25048
YOSHINAGA, Haruma, Measurement of T(d,n) reaction neutron flux, 18: 26590
YOSHITOSHI, Yowaru, Simultaneous kinetics study of ^{131}I-hippuran and ^{197}I-rose bengal by double isotope technique. II., 18: 25050
YOSIM, S. J., Heat capacities and compressibilities of liquids, 18: 25367
YOUMANS, Arthur H., Method of radioactivity tracer logging, 18: 25703
YOUNG, F. J., Interaction of transverse waves and a moving ionizing shock wave, 18: 26125

YOUNG, H. B., Jaundice after halothane and radiotherapy, 18: 25118
YOUNG, J. A., Neutron thermalization in Zr hydride, 18: 26514
YOUNG, J. C., Neutron thermalization in Zr hydride, 18: 26514
YOUNG, J. E., Intermediate resonance structure in continuum shell model. I., 18: 26531 (LADC-6007)
YUILE, C. L., Behavioral effects in pigeons exposed to Hg vapor, 18: 25057 (UR-645)
YUNUSOV, M. S., Effects of γ radiation on optical properties of synthetic ruby, 18: 26078
YURMANOV, E. E., Experimental investigation of plasma instability in magnetic mirror trap, 18: 26695 (AEC-tr-5589(p.83-96))

Z

ZACHARIAS, A., Current fluctuations in superconducting circuit, 18: 26484
ZADRA, J. B., Electrodeposition of Mo from molten electrolytes, 18: 25316 (BM-RI-6444)
ZAGORODNOV, O. G., Measurements of h-f fields in plasma waveguide, 18: 26778
ZAHND, J. P., Liver in Lacerta and Accara after ThO_2 injection, 18: 25066
ZAITOVA, M. S., Incorporability of labeled amino acids in protein of animal organism, 18: 25198
ZALESKI, C. P., Neutron propagation in blocks of natural U and steel, 18: 26521
ZALESKIEWICZ, T. P., Optical bleaching of V_2 centers in KCl, 18: 26084
ZAMBONI, F., Threshold energy of the $T(p,n)He^3$ reaction, 18: 26616
ZAPOLSKY, H. S., Dynamical stability of neutron star models, 18: 26199
ZARIPOV, M. M., Electron paramagnetic resonance of Gd^{3+} in CaF_2, 18: 25416
ZARLAVSKII, G. M., Anomalous plasma diffusion in magnetic field, 18: 26772
ZAVADOVSKAYA, E. K., Radiation stability of alkali-halide crystals, 18: 25585
ZAVEL'SKII, F. S., Mass coefficients for absorption of γ radiation in soils, 18: 25700
ZERNIK, Wolfgang, Two-photon ionization of atomic H, 18: 26218
ZHDANOV, G. B., Cosmic radiation physics, 18: 26245
ZHDANOV, G. S., Neutron diffraction study of perovskite-like substances, 18: 25418
ZHELEZNYAKOV, V. V., Gyroresonance radiation and absorption in equilibrium magneto-active plasma, 18: 26721
ZHEZHERUN, I. F., Diffusion of neutrons in Be by pulse technique, 18: 26502
ZIDER, R. E., Amplifier for particle accelerators, 18: 26184
ZIMAN, J. M., Method of neutral pseudo-atoms in theory of metals, 18: 25897
ZIMANYI, J., Stripping matrix element with finite range interaction, 18: 26626
ZIMMERMANN, H. G., Pickling of Zr alloys, 18: 25902
ZINN, Walter H., Neutronic reactor system, 18: 26892
ZITNANSKY, Bohumil, Isolation of carbide phase from Ti–W alloyed Cr–Ni steel, 18: 25289
ZIV, D. M., Actinium–Be sources for industrial geophysical investigations, 18: 25873
ZIZZA, M., Dual-purpose operation of the NPR, 18: 26950
ZMII, V. I., Diffusion reaction in Mo–Si system, 18: 26001
ZMII, V. I., High-temperature oxidation of Mo silicides, 18: 25928
ZORN, G. T., Lifetime of K_1^0 mesons, 18: 26261 (BNL-837(p.42-52))
ZSEBOK, Zoltan, Disturbances of water circulation in experimental intestinal x-ray death, 18: 25155
ZUMWALT, L. R., Catalysis of steam–graphite and CO disproportionation reactions by Ba, Sr, and Cs, 18: 25321 (GA-5215)
ZUMWALT, L. R., Fission-product-element yields and characteristics, 18: 25322 (GAMD-891(Rev.1))
ZUPAN, J., Prog. rpt. on coatings for Nb alloys, 12/62–2/63, 18: 25896 (PF-63-3)
ZWICKLER, R., Superheating H_2O-moderated reactor, 18: 26945
ZWIEBEL, Imre, Free-radical yields in n-alcohols resulting from irradiation, 18: 25538
ZYLICZ, J., Possible four-quasiparticle excited state of Er-166, 18: 26632

SUBJECT INDEX

Main entries in this index are generally specific materials, things, and processes. These are followed by modifiers that describe the properties of, and processes applied to, the main entries.

The number preceding the colon is the *NSA* volume number, and the number following is the abstract number. The designation (R) following the abstract number indicates that the abstract is of a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. References to report numbers, where appropriate, are included after the abstract number of the citation. Published literature (journal article or book) is indentifiable by the absence of a report number.

General Indexing Style

The user should bear in mind that the ideas presented in the original literature, rather than key words, have been indexed. The indexers have tried to select what seemed the most probable and logical place to look for typical information. Since it is not possible to anticipate where a user would look for information, numerous cross references are included to assist him in his search.

Experience in using an index of this type will be the best guide in obtaining the desired information, and a consideration of synonymous or closely related terms will prove valuable.

Information must be so indexed as to be of the greatest use to the greatest number of users. This requires that a topic be indexed to headings that most specifically describe it and not ordinarily to the headings that describe its ultimate use, nor to the general class headings that include the specific headings. For example, information on the treatment of thyroid disease with I-131 would be indexed under Thyroid Diseases and under Iodine Isotopes I-131, but not necessarily under Radiotherapy. A study of the effects of x radiation on hair would be indexed under both X Radiation and Hair. However, the information would not be indexed under the experimental animal, e.g., Rats, unless the report discusses the effects on rat hair as compared with the effect on the hair of other animals.

The broad, general class headings are used only for general information or for comprehensive reports or articles.

Subject Heading Styles

Generally, the direct form of subject entry is used rather than inverted headings or, in some cases, subheadings; e.g., Amino Acids rather than Acids, amino; Helium Isotopes He-4 rather than Helium—isotopes He-4 or Helium—He-4 isotopes. Note, however, that in some cases modifying terms are used parenthetically in preference to a more direct type of entry which would result in the scattering of information. Organic compounds, however, are usually entered in the index in the inverted form so that substituted compounds can be listed near the parent compound; e.g., Benzene, Bromo- rather than Bromobenzene. In general, the style of nomenclature used is that of *Chemical Abstracts*, except that some items listed in that publication as subheadings are elevated to form part of the main heading; e.g., Butyric Acid, Methyl Ester rather than Butyric Acid—methyl ester.

Alphabetization

Main headings are arranged according to the widely accepted word-by-word alphabetic system. A parenthetic qualifier following a main heading is disregarded in alphabetizing unless there are two or more headings identical except for the parenthetic qualifier, in which case the qualifier determines the order. Headings involving Greek letters are arranged as if the names of the letters were spelled out, e.g., Mesons (π), Mesons (ξ).

Nomenclature of Inorganic Compounds

Inorganic compounds are indexed in the direct form, listing cations in the order of increasing valence in the case of polycationic salts of varying valence and in alphabetic order for polycationic salts in which all cations have the same valence; e.g., Sodium Aluminum Silicates and Potassium Sodium Sulfates.

Multicomponent Systems

Multicomponent alloys, except well-known trade names are indexed under each element in the alloy.

Example: Aluminum–Chromium Alloys are indexed

ALUMINUM ALLOYS
Al–Cr ...
CHROMIUM ALLOYS
Al–Cr ...

Well-known alloys such as Hastelloy are indexed directly with cross references under the element components. Multicomponent systems of elements are indexed similarly.

Example: Silicon–Tungsten Systems are indexed

SILICON SYSTEMS
Si–W ...
TUNGSTEN SYSTEMS
Si–W ...

Multicomponent systems of compounds are similarly indexed under the compound.

Physical States of Materials

In this subject index specification of the physical state of the material, if other than normal, is included in the modifying phrase.

Modifying Phrases (Subheadings)

Descriptive phrases (modifiers), rather than ordinary subheadings, are used under the main headings to give a better indication of the material covered in an abstract than would be possible with only a word or two whenever it appears that such information would be useful. Such phrases are written so that the idea considered most important is presented first, should a not-too-awkward expression result. However, when using this index, the reader is advised to scan all modifiers under a main heading to determine whether any abstracts in addition to the most obvious should be consulted for the desired information. Many of the modifiers are designed to be read in inverted order or to be read with the main heading inserted at the position of the comma in order to obtain a meaningful phrase; e.g., Uranium—allotropic transformation temperatures of, effect of cooling rate on is read "effect of cooling rate on allotropic transformation temperatures of uranium." In many cases, the prepositions have been omitted from such phrases provided no ambiguity results from the omission.

A

ABDOMEN
protective effects of screening of, against radiation sickness in rats, 18: 25225
ABSTRACTS
on determination of trace amounts of cadmium, chromium, cobalt, iron, manganese, and molybdenum in uranium and uranium compounds, 18: 25272 (VDDIT-90)
on developments in plutonium technology, May 1, 1964, 18: 26981 (HW-68600-38)
on radiation effects on solid uranium-based nuclear fuel materials, 18: 26072 (VDDIT-16(4.2))
on transportation of radioactive materials, 18: 25713 (VDDIT-89)
ACCELERATORS
amplifier design for particle, 18: 26184(P)
beam deflection system for, 18: 26185(P)
beam profile equations for, 18: 26172
design of DC-Tron, 18: 26182(P)
design of high-velocity, for small projectiles, 18: 25636
electromagnetic fields excited in cavities of, by charged particle beams, calculation of, 18: 26181
particle oscillations in cyclic, 18: 26180
plasma, design for inducing fusion reactions, 18: 26810(P)
storage ring, design of 240-Mev electron-positron, 18: 26158
ACETALDEHYDE
effects on hydrogen yields in radiolysis of liquid ethanol, 18: 25589
radioinduced polymerization with dimethylketene, products and reactivity of, 18: 25494(T) (AEC-tr-6372(p.237-46))
radioinduced polymerization of solid, epitaxy in, 18: 25502(T) (AEC-tr-6372(p.323-30))
radioinduced reaction with ethylene, pressure and temperature effects on, 18: 25509(T) (AEC-tr-6372(p.397-404))
acetaldehyde–cyclohexene, radioinduced telomerization of, 18: 25510(T) (AEC-tr-6372(p.405-12))
acetaldehyde–hexene, radioinduced telomerization of, 18: 25510(T) (AEC-tr-6372(p.405-12))
ACETIC ACID
effects on ion exchange of uranium and other elements in system with organic solvents, 18: 25305
effects on radioinduced graft polymerization of celluloses on styrene, 18: 25474(T) (AEC-tr-6372(p.83-8))
effects on radioinduced polymerization of acrylonitrile and styrene on viscose rayon, 18: 25476(T) (AEC-tr-6372(p.97-102))
ACETIC ACID, CHLORO-
effects on hydrogen yields in radiolysis of liquid ethanol, 18: 25589
effects on ion exchange of uranium and other elements in system with organic solvents, 18: 25305
ACETIC ACID, DICHLORO-
effects on ion exchange of uranium and other elements in system with organic solvents, 18: 25305
ACETIC ACID, (ETHYLENEDIAMINE)TETRA- COMPLEXES
with uranium, formation constants and spectra of, 18: 25380
ACETIC ACID, [(2-HYDROXYETHYL)IMINO]DI-
complexes with uranium, equilibrium and stability of, 18: 25391
ACETIC ACID, IMINODI-
complexes with uranium, equilibrium and stability of, 18: 25391
ACETIC ACID, TRICHLORO-
effects on ion exchange in uranium and other elements in system with organic solvents, 18: 25305
ACETIC ACID, VINYL ESTER
radioinduced polymerization in presence of iodine, spectra of product in, 18: 25507(T) (AEC-tr-6372(p.379-85))
radioinduced polymerization in liquid sulfur dioxide, 18: 25537(T) (AEC-tr-6372(p.617-25))
ACETONE
effects on hydrogen yields in radiolysis of liquid ethanol, 18: 25589
effects on ion exchange of uranium and other elements in system with organic acids, 18: 25305
effects on radioinduced graft polymerization of cellulose on styrene, 18: 25474(T) (AEC-tr-6372(p.83-8))
effects on yields in radiolysis of *α*- and *p*-toluenethiol, 18: 25549
hydroxy-, yields in radiolysis of acetone in aqueous solutions, 18: 25582
radiation effects on color of, ESR spectra of, 18: 25521(T) (AEC-tr-6372(p.491-2))
radioinduced polymerization with dimethylketene, products and reactivity of, 18: 25494(T) (AEC-tr-6372(p.237-46))
radiolysis of aqueous solutions of, acidity effects and yields in, 18: 25582
ACETONE, THENOYLTRIFLUORO-
analytical use in determination of plutonium in urine, 18: 25299
solvent properties for tin-128, 18: 25274
solvent properties for americium and europium, 18: 25622
ACETOPHENONES
radioinduced polymerization with dimethylketene, products and reactivity of, 18: 25494(T) (AEC-tr-6372(p.237-46))
ACETYLENE
detonation of, in presence of oxygen, plasma production in, 18: 26765
dissociation of ionic, 18: 25336
ACID CARBONATE COMPLEXES
with europium and neodymium, ion exchange studies, 18: 25438
ACROLEIN
radioinduced polymerization of, temperature effects on products of, 18: 25546
ACRYLAMIDE
radiation effects on ESR spectra of, temperature effects on, 18: 25517(T) (AEC-tr-6372(p.459-64))
radioinduced graft polymerization on PVA, 18: 25485(T) (AEC-tr-6372(p.159-61))
radioinduced polymerization of liquid, effects of DPPH and oxygen on, 18: 25536(T) (AEC-tr-6372(p.613-16))
ACRYLIC ACID
radiation effects on radical anisotropy in, ESR spectra of, 18: 25518(T) (AEC-tr-6372(p.465-71))
radioinduced polymerization of, ESR spectra of, 18: 25519(T) (AEC-tr-6372(p.473-80))
ACRYLIC ACID POLYMERS
solution properties, effects of tacticity on, 18: 25463
ACRYLONITRILES
radioinduced graft polymerization on casein, 18: 25469 (SRIA-120)
radioinduced graft polymerization on viscose rayon solvent effects on, 18: 25476(T) (AEC-tr-6372(p.97-102))
radioinduced graft polymerization to polypropene, effects of additives and alpha pre-irradiation on, 18: 25505(T) (AEC-tr-6372(p.363-9))
radioinduced graft polymerization on polypropene, effects of additives and alpha pre-irradiation on, 18: 25506(T) (AEC-tr-6372(p.371-7))
radioinduced polymerization with formaldehyde, kinetics of, 18: 25492(T) (AEC-tr-6372(p.213-22))
radioinduced polymerization with methyl methacrylate and styrene, 18: 25535(T) (AEC-tr-6372(p.603-12))
acrylonitrile–butadiene, product composition in radioinduced graft polymerization with cellulose, 18: 25480(T) (AEC-tr-6372(p.125-7))
acrylonitrile–styrene, product composition in radioinduced graft polymerization with cellulose, 18: 25480(T) (AEC-tr-6372(p.125-7))
acrylonitrile–butadiene, radioinduced graft polymerization on celluloses, 18: 25479(T) (AEC-tr-6372(p.117-23))
acrylonitrile–butadiene, radioinduced graft polymerization on PVA, 18: 25482(T) (AEC-tr-6372(p.135-40))
acrylonitrile–butadiene, structural effects in radioinduced graft polymerization on celluloses, 18: 25481(T) (AEC-tr-6372(p.129-34))
ACTINIDES
magnetism and superconductivity in, 18: 26475
separation of trivalent, by ion exchange, 18: 25631(P)
ACTINIUM
nuclear properties for use with beryllium as neutron source, 18: 25873
ACTIVATION ANALYSIS
book: *Radioactivation Analysis*, 18: 25310
performance of, for neutron flux measurements, 18: 26590
ADENOSINE
S-adenosylmethionine, reaction kinetics of, in biological transmethylation, 18: 25061
ADIPIC ACID
precipitation of cerium and lanthanum using, 18: 25351
ADRENAL GLANDS

radiation effects on activity of, in man, 18: 25104
ADRENAL HORMONES
radiation effects on content of, in urine, 18: 25104
ADRENOCORTICOTROPIC HORMONE
protective effects of, against radioinduced leukemia in mice, 18: 25226
ADVANCED TEST REACTOR
open-loop analog simulation study of, 18: 26825 (BAW-1228)
AGE
effects of, in dogs, 18: 25089(R) (UCD-472-109(p.18-44))
effects of, on incidence of neoplasms in irradiated dogs, 18: 25093(R) (UCD-472-109(p.62-172))
effects on atherosclerosis development in pigeons, 18: 25087(R) (TID-20641)
effects on radiosensitivity of onion seeds, 18: 25179
AGE ESTIMATION
carbon-14 method of, for loess soils of Russian Steppe, 18: 25685
interpretation in tritium groundwater, 18: 25701
of snow in Antarctic using lead-210, 18: 25702
performance of radiometric methods for meteoritic, 18: 26189
potassium-40/potassium-41 method of, for cosmic-ray-exposure ages of iron meteorites, 18: 26198
AGRICULTURE
effects of thermonuclear attack on farm animals, 18: 25732
AIR
radiation dose rate in, at various sites throughout U. S., 1962 and 1963, spectrometric determination of, 18: 25694
radiation intensity at sea level, soft beta, 18: 26102
radioactivity monitoring in, evaluation of filter media for, 18: 26098 (NRL-6054)
radioactivity of, in Pacific Ocean, 131° 57′E to 164° 00′W longitude and 52° 57′ to 08° 45′N latitude, 1961, 18: 25690
radioinduced formation of nitrogen oxides and ozone in, 18: 25718
radioisotope concentrations in, maximum permissible, 18: 25733
reactions with beryllium at 1000 to 1500°C, kinetics and products of, 18: 25328(R) (SC-DC-64-864)
air-ethylene glycol, theory of two-phase annular flows of, 18: 25657(R) (NYO-3114-1)
air-silicon fluids, theory of two-phase annular flows of, 18: 25657(R) (NYO-3114-1)
air-water, theory of two-phase annular flows of, 18: 25657(R) (NYO-3114-1)
ALANINE
radioinduced polymerization of N-carboxy anhydrides of, mechanism of, 18: 25495(T) (AEC-tr-6372(p.247-59))
ALASKA
fallout monitoring, 1959 to 1964, 18: 25055 (NP-13985)
ALIZARIN RED S COMPLEXES
with zirconium, separation by solvent extraction using butanol, 18: 25306
ALKALI METAL BORATES
radiation effects on ESR spectra of, gamma, 18: 26079
ALKALI METAL HALIDES
iodine-129 Mössbauer effect in, 18: 26111 (NP-13990)
radiation stability of divalent-impurity-containing, x-, 18: 25585(T)
spectra in, optical absorption, 18: 25408
ALKALI METALS
diffusion and solubility of transition metals in, development of equipment and methods for studying, 18: 25314(R) (AI-64-75)
preparation of pure, 18: 25912(P)
ALKALINE EARTH METALS
preparation of pure, 18: 25912(P)
ALKANES
properties for use as diluent for TBP in solvent extraction processes, 18: 25605 (DP-882)
ALKENES
radiolysis in presence of iodomethane, spectral studies on uv, 18: 25588
ALLANITES
age estimation by x-ray fluorescence lead–uranium ratio measurements, 18: 25704
ALLOYS
bonding dissimilar, co-extrusion, 18: 25953
deformation processing of, research program on, 18: 25952
ALPHA PARTICLES
angular correlations for aluminum-27 (d,α) reactions, excitation functions in, 18: 26634
angular distribution in ternary fission of uranium-235, 18: 26557 (PAR-481/1)
angular distributions from proton reactions with fluorine-19, 18: 26664
detection and measurement using silicon surface barrier detector, output pulse amplitudes and waveforms from, 18: 25786 (NAS-NRC-Pub-1184 (p.49-52))
dosimetry of, in skin, 18: 25083 (AHSB(RP)R-39(p.44-68))
effects on fluorescence of organic scintillation crystals, 18: 25594
effects on graft polymerization of polypropene to acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, pre-exposure, 18: 25505(T) (AEC-tr-6372(p.363-6))
effects on radioinduced graft polymerization of polypropene on acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, pre-exposure, 18: 25506(T) (AEC-tr-6372(p.371-7))
effects on sodium chloride crystals at 40 Mev, visible, 18: 26071 (NASA-TN-D-2329)
reactions (α,αn), (α,n), (α,2n), (α,2p), and (α,2pn) with scandium-45 at 15 to 40 Mev, excitation functions for, 18: 26649
reactions (α,n) and (α,2n) with lead-206, polonium-210 production in, 18: 26647
reactions with bismuth, astatine isotope production in, 18: 26602
reactions with lead, astatine isotope production in, 18: 26602
reactions with nickel-58 to 48 Mev, shell effects in, 18: 26599
scattering by bromine-81, Coulomb excitation from, 18: 26552(R) (ORNL-3582(p.112-14))
scattering by magnesium-24, elastic and inelastic, 18: 26550(R) (ORNL-3582(p.101-2))
scattering by nuclei, strong absorption model for elastic, 18: 26563
scattering by oxygen-18 at 2.4 to 3.5 Mev, differential cross sections for elastic, 18: 26645
spectra from lanthanum-139 (n,α) reactions, 18: 26606
trajectory in xenon, distribution of photons and ions along, 18: 26121
ALPHA SOURCES
development of polonium, review of, 18: 25590
ALPHA SPECTROMETERS
design of 180° double-focusing, 18: 25841
stabilization of multichannel, digital methods for, 18: 25804 (NAS-NRC-Pub-1184(p.150-64))
ALUMINUM
alloying effects on oxidation of plutonium–uranium alloys, 18: 26893(R) (ANL-6868(p.11-108))
alloying effects on corrosion properties of types 405 and 406 stainless steel, 18: 26894(R) (ANL-6868(p.109-16))
beta transmission through, backscattering from, 18: 26813(T) (AEC-tr-6372(p.17-28))
corrosion by steam at 540°C, 18: 25920(R) (ANL-6868(p.338-54))
deposition on niobium–zirconium alloy by slurry dip and spray method, 18: 25896(R) (PF-63-3)
dissolution of irradiated, equipment and methods for, 18: 25610 (SGAE-CH-4/1964)
dissolution of, media for, 18: 26903
electron absorption by, effects of excitation, ionization, and Coulomb scattering on, 18: 26823
electron backscattering at 8 to 22 Mev, 18: 26216
electron beam energy losses at 4 to 15 kev, 18: 26822(T)
electron beam transmission through films of, energy spectra of 0.5- to 12-kev, 18: 26821(T)
energy gap in superconducting film of, 18: 26487
energy gap of superconducting films of, 18: 26488
exploding wire phenomena in, plasma production in underwater, 18: 26754
fabrication of tubular, 18: 25939(R) (ANL-6868(p.201-18))
gamma buildup factors for, 0.5- to 10-Mev, 18: 26814(T) (ORNL-tr-80)
mechanical properties at high pressures and temperatures, 18: 25972 (ASD-TDR-63-90(Vol.II))
melting point of, correlation with energy of motion of monovacancies, 18: 26037
melting temperature of, equations for calculating, 18: 25990
neutron scattering by, dose measurements in small-volume, 18: 26532

(NAA-SR-9418)
neutron scattering cross sections at 0.5 to 0.8 Mev, 18: 26571
neutron scattering cross sections for, subthermal, 18: 26662
production by fusion electrolysis, 18: 25913(P)
proton elastic scattering at 180 Mev, strong absorption model for, 18: 26562
spectra in strongly ionized plasma, broadening and shifting of lines of, 18: 26710(T) (AEC-tr-6227/1(p.15-24))
thermal properties, 18: 26896(R) (ANL-6868(p.133-74))

ALUMINUM ALLOYS
corrosion of A-288 and Trefimetaux, by water at 290 and 315°C, 18: 25919(R) (ANL-6868(p.190-200))
corrosion of A238, by aqueous magnesium sulfate solutions at 620°C, 18: 25920(R) (ANL-6868(p.338-54))
corrosion of 1100, by helium- and oxygen-saturated water at 50 and 70°C, 18: 25920(R) (ANL-6868(p.338-54))
Al–Cu, radiation effects on structure of crystalline, 18: 26069(R) (ANL-6868(p.373-417))
Al–Cu, radiation effects on strength of single crystal, 18: 26074
Al–Cu–Mg–Zn, corrosion resistance of, effects of age hardening, chromium, and silver on stress, 18: 25946(T) (RSIC-177)
Al–Dy, structure of Dy_3Al_2, 18: 25989
Al–Dy, structure of $DyAl_2$, 18: 25989
Al–Fe–U, fabrication for minimum irradiation growth, 18: 25910(P)
Al–Fe–U, radioinduced dimensional changes, 18: 25910(P)
Al–Gd, structure of Gd_3Al_2, 18: 25989
Al–Ho, phase studies of intermetallic compounds in, 18: 26036
Al–Mg, reactions of 6061 alloy with steam, 18: 26824(R) (ANL-6885)
Al–Mg–Mn, creep properties at high temperatures, 18: 26066(P)
Al–Mo–Sn–Zr, corrosion by sodium, 18: 25937
Al–Pu, compatibility with Zircaloy-2 at 600°C, 18: 26893(R) (ANL-6868(p.11-108))
Al–Tc, crystal structure and phase studies, 18: 25970(R) (ANL-6868 (p.303-25))
Al–U, dissolution by mercuric nitrate–nitric acid, 18: 25269(R) (NLCO-905)
Al–Zn, radiation effects on zone formation in crystalline, 18: 26069(R) (ANL-6868(p.373-417))
Al–Zr, analysis for uranium, fluorometric, 18: 25283

ALUMINUM CHLORIDE ETHERATES
reactions with beryllium etherates, 18: 25431
$AlCl_3 \cdot (C_2H_5)_2O–BeCl_2 \cdot 2(C_2H_5)_2O$, phase studies and solubility, 18: 25431

ALUMINUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

ALUMINUM ISOTOPES Al-25
beta-decay branching ratios in, 18: 26565

ALUMINUM ISOTOPES Al-26
beta-decay branching ratios in isomeric, 18: 26565

ALUMINUM ISOTOPES Al-27
deuteron reactions (d,α) at 4.50 to 5.62 Mev, 18: 26634
energy levels, 3-Mev doublet, 18: 26613
neutron reactions (n,γ) with, spectra from resonant, 18: 26542(R) (ORNL-3582(p.71-5))
nuclear magnetic resonance in $PuAl_2$, 18: 26522(R) (ANL-6868(p.326-30))
nuclear magnetic resonance, quadrupole, 18: 26625
photon reactions at 150 to 720 Mev, 18: 26589
proton reactions (p,2p) at 185 Mev, 18: 26567
proton reactions (p,γ) with, 18: 26661

ALUMINUM NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

ALUMINUM OXIDES
corrosion by cesium in in-pile thermionic cells, 18: 26259
electric discharge thermal shock effects on, 18: 26806
electric properties, 18: 26058
fission track formation in, 18: 26069(R) (ANL-6868(p.373-417))
preparation of monocrystalline, 18: 25893(R) (ANL-6868(p.355-72))
radiation effects on hydrogen adsorption by, 18: 25468 (BNL-845)
radiation effects on catalytic activity of, 18: 25468 (BNL-845)
sorptive properties of gamma, for ortho-hydrogen and para-deuterium at 20.4°K, 18: 25442
sputtering by argon at 12 kev, 18: 26806

ALUMINUM PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

ALUMINUM SYSTEMS
Al–Fe–Si–U, fabrication of rods and tubes by rolling, 18: 25940 (BMI-X-294)
Al–Ni–Si, corrosion behavior and mechanical properties in high-temperature water, 18: 25931

AMERICIUM
separation by solvent extraction using chelating acids, 18: 25622

AMERICIUM ISOTOPES Am-241
neutron spectrum from sources using beryllium and, 18: 26510
production in fast power reactors, economics of, 18: 26927 (TID-20647)

AMIDE POLYMERS
radiation effects on reactions with chlorine and sulfur dioxide, 18: 25490(T) (AEC-tr-6372(p.197-205))

AMIDES
radiolysis in carbon tetrachloride, 18: 25572

AMINES
properties of biologically active, 18: 25086(R) (TID-20636)

AMINO ACIDS
analysis for carbon-14, using scintillating organic anion exchange resin, 18: 25259 (NYO-10405)
radiation effects on metabolism of, in rabbits, 18: 25198

AMMONIA
metabolism by plants, tracer studies of effects of copper on, 18: 25059(T) (OTS-63-11008(p.6-14))
plasma of, production in cascade arc heater, 18: 26687 (ARL-64-49)
radiolysis of aqueous solutions of, mechanisms and reaction rates of, 18: 25583
reactions with deuterated 1,2-dibromoethane, production of carbon-deuterated ethylenediamine dihydrobromide by, 18: 25458
use in fusion electrolytic production of metals, 18: 25913(P)
yields in radiolysis of aqueous glycine, 18: 25584
NH_3–Na, electron-nuclear double resonance studies of solutions of, 18: 26154

AMMONIUM CARBONATES
effects on ion flotation of uranyl ions, concentration, 18: 25375

AMMONIUM CHLORIDES
tetraethyl-, chlorine isotopic exchange with substituted phosphoryl chlorides, 18: 25441

AMMONIUM COMPOUNDS, QUATERNARY
tetraethylammonium chloride, chlorine isotopic exchange with substituted phosphoryl chlorides, 18: 25441

AMMONIUM NEODYMIUM SULFATES
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354

AMMONIUM PHOSPHOMOLYBDATES
ion exchange properties for bivalent and trivalent ions, mechanism of, 18: 25378

AMMONIUM PRASEODYMIUM SULFATES
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354

AMMONIUM SAMARIUM SULFATES
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354

AMPLIFIERS
design and performance of low-noise pre-, for semiconductor detectors, 18: 25789 (NAS-NRC-Pub-1184(p.61-4))
design criteria for fast transistorized linear, with large dynamic range, 18: 25793 (NAS-NRC-Pub-1184(p.89-95))
design for semiconductor detectors, 18: 25794 (NAS-NRC-Pub-1184 (p.96-103))
design of charge-sensitive low-noise, for ionization chambers and semiconductor detectors, 18: 25790 (NAS-NRC-Pub-1184(p.65-9))
design of high-power broad-band video-frequency linear, for particle accelerators, 18: 26184(P)
design of multiplier circuits using logarithmic diodes, 18: 25801 (NAS-NRC-Pub-1184(p.140-2))
design of pre-, using field-effect transistors, 18: 25812 (NAS-NRC-Pub-

1184(p.204-6))
development of transistorized current-operated, for pulse-height analyzers, 18: 25792 (NAS-NRC-Pub-1184(p.79-88))
gating and timing systems for linear, 18: 25799 (NAS-NRC-Pub-1184 (p.124-34))
gating circuits for biased, transistorized linear, 18: 25797 (NAS-NRC-Pub-1184(p.119-20))
gating circuits for biased, transistorized linear, 18: 25798 (NAS-NRC-Pub-1184(p.121-3))
use of field-effect transistors in charge-sensitive, 18: 25791 (NAS-NRC-Pub-1184(p.70-8))

AMYL ALCOHOL
effects on radioinduced graft polymerization of celluloses on styrene, 18: 25474(T) (AEC-tr-6372(p.83-8))
formation by beta radiation of ethylene–isopropanol mixture, 18: 25511(T) (AEC-tr-6372(p.413-19))
radiolysis of, free radical yields in gamma, 18: 25538

ANEMIA
effects of, on erythropoietin content of blood, 18: 26988 (TID-20635)

ANESTHESIA
effects of halothane, on patients undergoing radium treatment of cervical carcinoma, 18: 25118
effects on blood circulation in heart of dogs, 18: 25040

ANESTHETICS
liver damage after radiotherapy and, 18: 25119

ANILINE
thermal and radioinduced polymerization of, products of, 18: 25496(T) (AEC-tr-6372(p.261-72))

ANIMAL CELLS
multiplication of, computer analysis of, 18: 26982(R) (NYO-2462-1)
photodynamic reactions in, 18: 26983 (NYO-2734-1)
radiation effects on rabbit tissue culture as affected by biochemistry and morphology of, x, 18: 25117
radiation effects on synthesis of nucleic acid, protein, desoxyribonucleic acid, and ribonucleic acid by strain L, 18: 25209
radiation effects on HeLa, tritium, 18: 25156
radiation effects on chicken corneal, lethal, 18: 25169
radiation effects in, parameters for multi-target and multi-hit survival curves in, 18: 25170
radiation effects in, calculation of survival curves based on multi-target or multi-hit model, 18: 25171
radiosensitivity of, in tissue culture, effects of hypothermia on, 18: 25204
radiosensitivity of HeLa cells, effects of dose rate on, 18: 25187

ANIMAL REPRODUCTION
radiation effects on, in dogs, 18: 25092(R) (UCD-472-109(p.53-61))
radiation effects of whole-body and local x-irradiation on, 18: 25215(T) (AEC-tr-6227/1(p.25-44))
radiation effects on, in guinea pigs, 18: 25230

ANIMALS
farm, effects of thermonuclear attack on, 18: 25732
gold-198 distribution and dosimetry in, after intraperitoneal injection, 18: 25071

ANION EXCHANGE MATERIALS
radiation effects on exchange capacity and specific volume, gamma, 18: 25541
sorptive properties for metals in hydrobromic and hydrochloric acids and lithium chloride, 18: 25373
synthesis and efficiency of scintillating organic resin for detection of radionuclides in solutions, 18: 25259 (NYO-10405)

ANIONS
separation by thin-layer ionophoresis, tracer techniques in, 18: 25612(T) (ORNL-tr-128)

ANTARCTICA
age estimation of snow in, lead-210, 18: 25702

ANTHRACENE
effects on hydrogen yields in radiolysis of liquid ethanol, 18: 25589
radioinduced polarization of fluorescence from, 18: 25594
radioinduced thermoluminescence in, factors affecting, 18: 25472(T) (AEC-tr-6372(p.61-74))

ANTIBODIES
formation in rabbits during irradiation, protective effects of gelatin and serum on leptospirosis, 18: 25228

ANTIHYPERONS ($\bar{\Xi}^+$)
production in antiproton-deuteron interactions at 2.8 Bev/c, 18: 26334

ANTIMONY
neutron elastic scattering at 5.0 Mev, angular distribution, 18: 26668
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26668
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374

ANTIMONY ALLOYS
Sb–In, carrier lifetime at high density in, 18: 26106 (D1-82-0306)

ANTIMONY ISOTOPES Sb-124
beta decay of, finite size in nuclear matrix elements for, 18: 26631
beta decay of, $3^-(\beta)2^+$ transitions in, 18: 26607

ANTINEUTRINOS
interactions with protons, form factors in, 18: 26268 (BNL-837 (p.249-56))

ANTIPROTONS
interactions with protons, meson (ρ) production in, 18: 26286
interactions with deuterons at 2.8 Bev/c, hyperons (Λ), ($\bar{\Sigma}^-$), and ($\bar{\Xi}^+$) production in, 18: 26334
interactions with protons at high energies, anti-shrinkage in diffraction, 18: 26365

ARABINOSE
oxidation by sodium chlorite tritium kinetic isotope effects in, 18: 25459

ARGON
additive effects on lifetime of metastable helium atoms, 18: 26238
analysis for impurities, instruments for, 18: 25264 (CNLM-4016)
bubble release and swelling in solids, model for, 18: 26080
charge transfer with protons, cross sections for Lyman alpha emission from, 18: 26235
diffusion in latex and neoprene, 18: 25315 (AWRE-O-56/57)
ionization by 8 to 100 kev ions, 18: 26217
melting temperature of, equations for calculating, 18: 25990
plasma of, production in cascade arc heater, 18: 26687 (ARL-64-49)
superheat in nucleate boiling of, 18: 26461
transport properties of atomic gases of, 18: 26136

ARGON IONS
electron-capture cross sections at 0.4 to 3.6 kev, 18: 26229
ionization of argon by 8 to 100 kev, 18: 26217
sputtering on oxides at 12 kev, 18: 26806

ARGON ISOTOPES Ar-40
proton reactions (p,n), resonances in, 18: 26672

ARGON SYSTEMS
Ar–methane, performance as proportional counter gas, 18: 25831

ARGONNE ADVANCED RESEARCH REACTOR
kinetics, 18: 26824(R) (ANL-6885)

ARGONNE FAST REACTOR EXPERIMENT TEST
design and operations, 18: 26824(R) (ANL-6885)
fuel element development and testing, 18: 26893(R) (ANL-6868(p.11-108))

ARGONNE NATIONAL LAB., LEMONT, ILL.
information processing systems at, review of, 18: 25744 (NAS-NRC-Pub-1184(p.38-9))

ARGONNE SYNCHROTRON
equipment for neutrino experiments with, 18: 26166 (BNL-837(p.170-89))

ARSENIC
determination in hydrochloric and nitric acids, activation, 18: 25286
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chlorides, 18: 25374

ASCORBIC ACID
radiation effects on content of, in brain tissue of dogs, 18: 25161
uses as elutant in ion-exchange separation of uranium from other metals, 18: 25611(T) (AEC-tr-6227/1(p.1-8))

ASPARTIC ACID
yields in radiolysis of aqueous glycine, 18: 25584

ASTATINE ISOTOPES At-207
production in charged particle reactions with bismuth and lead, 18: 26602

ASTATINE ISOTOPES At-208
production in charged particle reactions with bismuth and lead, 18: 26602

ASTATINE ISOTOPES At-209
production in charged particle reactions with bismuth and lead, 18: 26602

ASTATINE ISOTOPES At-210
production in charged particle reactions with bismuth and lead, 18: 26602
ASTATINE ISOTOPES At-211
production in charged particle reactions with bismuth and lead, 18: 26602
ASTROPHYSICS
formation of quasi-stellar radio sources, spherical galaxies in process of, 18: 26196
neutrino-interaction data from, 18: 26187 (BNL-837(p.193-233))
ATHEROSCLEROSIS
radiation effects on development of, in pigeons, effect of dietary cholesterol levels, 18: 25087(R) (TID-20641)
ATMOSPHERE
cyclotron radiation from, v-l-f, 18: 26439
neutron flux distribution in, fast, 18: 26101
neutron fluxes in, from solar proton reactions, 18: 26446
pressure variations in, dynamical theory for, 18: 26456
radioactivity, 18: 25692
radioactivity of, nuclear explosion debris, 18: 26099
ATOMIC ENERGY
book: *From the Atomic Nucleus to the Nuclear Power Station*, in German, 18: 26943
book: *Nuclear Energy*, 18: 26241
ATOMIC ENERGY COMMISSION
by-product regulation program involving state cooperation, 18: 25715
ATOMIC ENERGY OF CANADA LTD. CHALK RIVER PROJECT, CHALK RIVER, ONT.
information processing facilities for physics research at, 18: 25742 (NAS-NRC-Pub-1184(p.23-35))
ATOMIC EXPLOSIONS
biological effects of, mathematical analysis of, 18: 25722
dating by fallout measurements in Calcutta, 1960 to 1961, 18: 25691
effects on ionospheric radio wave propagation at 834 kcps, 18: 26454
effects on radio signals from satellites, 18: 26100
electromagnetic pulse propagation from, shielding against, 18: 26819
radiation belts from Soviet, 1962, 18: 26444
radioactivity from high-altitude, atmospheric, 18: 26099
ATOMIC MODELS
applications of Thomas-Fermi, with hydrodynamic oscillations, 18: 26240
ATOMS
book: *From the Atomic Nucleus to the Nuclear Power Station*, in German, 18: 26943
book: *Nuclear Energy*, 18: 26241
electron scattering by impurity, in solids, 18: 26212
energy levels of, spin operators for, 18: 26211
energy-level spacing distributions in, 18: 26587
energy-level spectra of, statistical theory of, 18: 26588
fluorescence of Z = 12 to 42, corrections for continuous-radiation excitation in, 18: 26105 (CEA-R-2421)
Hartree-Fock orbitals of, perturbation expansions of unrestricted, 18: 26230
interactions with intense radiation fields, perturbation theory in, 18: 26423
properties, from Thomas-Fermi model with hydrodynamic oscillations, 18: 26240
quantum theory of, group theory in, 18: 26438
scattering factors, calculation of Hartree-Fock-Slater, 18: 26234
AUDITORY ORGANS
radiation effects on embryonic Amblystoma, protective effects of parabiosis against, x, 18: 25148
AUSTRALIA (VICTORIA)
nuclear power development in, evaluation of, 18: 26929
AVR REACTOR
neutron flux control in, 18: 26968
neutron flux measurements in, 18: 26967

B

BACTERIA
radiation effects on ability of rabbit liver polypeptides to agglutinate staphylococcus, x, 18: 25110
radiation effects on peroxidase activity in Mycobacteria, x, 18: 25111
radiation effects in, parameters for multi-target and multi-hit survival curves in, 18: 25170
BARITE CONCRETES
gamma buildup factors for, 0.5- to 10-Mev, 18: 26814(T) (ORNL-tr-80)
BARIUM
catalytic effects on carbon monoxide disproportionation reaction and on steam–graphite reaction, 18: 25321 (GA-5215)
diffusion from coated and uncoated ceramic fuel particles, 18: 25983 (SGAE-ME-1/1964)
melting temperature of, equations for calculating, 18: 25990
neutron elastic scattering at 0.5 to 0.8 Mev, cross sections for, 18: 26568
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
sorption by ammonium phosphomolybdates, mechanism of, 18: 25378
spectra of, hyperfine and isotopic structure of 5535 Å line in, 18: 26213(T)
spectra of, isotope shift and magnetic hyperfine structure in, 18: 26575
BARIUM ISOTOPES Ba-140
alpha decay of, energies and rates for, 18: 26640
BARLEY
radiation effects on nucleic acid metabolism during embryonic development in seeds of, 18: 25175
radiation effects on mutation frequencies in, 18: 25176
radioinduced tumors of leaves of, 18: 25178
radiosensitivity of seeds of, 18: 25182
BARYONS
interactions of, self-consistent model for strong, 18: 26344
interactions with leptons, field theory for, 18: 26267 (BNL-837 (p.237-48))
interactions with mesons, resonances in, 18: 26332
interactions with mesons, baryon-exchange model for inelastic, 18: 26351
mass splitting of, spontaneous, 18: 26360
models for, basic Su(3) triplets with integral charge in, 18: 26324
symmetries of, W_3, 18: 26350
BASES
complexes of Lewis, with europium dibenzoylmethide, 18: 25455
BATTERIES
radiation effects on electrodes of nickel–cadmium, gamma, 18: 26067(R) (AI-8971)
BEHAVIOR
effects of mercury vapor exposure on, of pigeons, 18: 25057 (UR-645)
of dogs, field studies of, 18: 25091(R) (UCD-472-109(p.49-52))
radiation effects on bird, after brain damage, proton, 18: 25099
radiation effects on, in mice, chronic, early exposure, 18: 25190
BELGIAN REACTOR-1
control and protection system of, electronic instrumentation for, 18: 26964
BENTONITES
use in beryllia compacts for increased resistance to radiation swelling, 18: 25965(P)
BENZALDEHYDE
radioinduced polymerization with dimethylketene, products and reactivity of, 18: 25494(T) (AEC-tr-6372(p.237-46))
radioinduced polymerization of, activation energy and kinetics of, 18: 25503(T) (AEC-tr-6372(p.331-47))
BENZENE
additive effects on radioinduced telomerization of acetaldehyde with cyclohexene or hexene, 18: 25510(T) (AEC-tr-6372(p.405-12))
effects on yields in radiolysis of α- and p-toluenethiol, 18: 25549
radiation effects on, ESR spectra of, 18: 25520(T) (AEC-tr-6372(p.481-90))
radioinduced thermoluminescence in, factors affecting, 18: 25472(T) (AEC-tr-6372(p.61-74))
radiolysis of aerated and deaerated aqueous solutions of, 18: 25464 (AE-142)
benzene–cyclohexane, energy transfer in radiolysis of, 18: 25544
benzene–cyclohexane, luminescence quenching by carbon tetrachloride in, 18: 25563
benzene–terphenyl, luminescence quenching by carbon tetrachloride in, 18: 25563

benzene–cyclohexane, radiolysis of, hydrogen isotopic yields in gamma, 18: 25566
benzene–cyclohexane, radiolysis of deuterated, hydrogen isotopic yields in gamma, 18: 25566
benzene–ethanol, yields in gamma radiolysis of, 18: 25545
BENZENE, CHLORO-
radiation effects on, ESR spectra of, 18: 25520(T) (AEC-tr-6372(p.481-90))
BENZENE, DICHLORO-
radiolysis using gamma radiation, analysis of yields from, 18: 25592
BENZENE, DISTYRYL-
derivatives of, preparation and properties of, 18: 25559
BENZENE, NITRO-
effects on yields in radiolysis of *o*- and *p*-toluenethiol, 18: 25549
BENZOIC ACID
additive effects on radioinduced graft polymerization of polypropene to acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, 18: 25505(T) (AEC-tr-6372(p.363-9))
additive effects on radioinduced graft polymerization of polypropene on acrylonitrile, 2-methyl-5-vinyl pyridine and styrene, 18: 25506(T) (AEC-tr-6372(p.371-7))
radiation effects on, ESR spectra of, 18: 25520(T) (AEC-tr-6372(p.481-90))
BENZOIC ACID, *p*-CHLORO-, MERCURY SALT
protective effects against radiation injuries in yeast, 18: 25224
BERYLLIUM
alloying effects on niobium oxidation, 18: 25936
alloying effects on corrosion of zirconium alloys by steam, 18: 26824(R) (ANL-6885)
beta transmission through, backscattering from, 18: 26813(T) (AEC-tr-6372(p.17-28))
chemical processing of, review on developments in, 18: 25949
combustion by air, carbon monoxide, nitrogen, and oxygen at 1000 to 1500°C, kinetics and products of, 18: 25328(R) (SC-DC-64-864)
content in solar atmosphere, 18: 26202
deformation of high-purity crystals of, 18: 25894(R) (NMI-2128)
dislocation structure and microstrain transition in, correlation of, 18: 25991
electric conductivity and Hall effect of, effects of strain on, 18: 25973 (ASD-TDR-63-605(Pt.II))
extrusion into fine, high-strength wires, 18: 25938(R) (AD-439498)
fabrication of foils, 18: 25939(R) (ANL-6868(p.201-18))
gas release and swelling in, model for, 18: 26080
growth and properties of crystals of, 18: 26009
mechanical properties at high pressures and temperatures, 18: 25972 (ASD-TDR-63-90(Vol.II))
melting temperature of, equations for calculating, 18: 25990
neutron diffusion in, absorption cross sections and transfer and diffusion lengths for, 18: 26502
neutron scattering by, dose measurements in small-volume, 18: 26532 (NAA-SR-9418)
neutron scattering cross sections for, subthermal, 18: 26662
neutron slowing down in, 18: 26248
neutron spectrum from sources using americium-241 and, 18: 26510
nuclear properties for use with actinium as neutron source, 18: 25873
photoionization absorption cross sections of, oxidation effects on, 18: 26215(T)
preparation and properties of, book on, 18: 25905
preparation and properties, 18: 26992
prismatic slip in zone-refined, effects of purity on, 18: 26049
production by fusion electrolysis, 18: 25913(P)
proton elastic scattering at 180 Mev, strong absorption model for, 18: 26562
proton reactions at 25 Bev, meson yields from, 18: 26165 (BNL-837 (p.91-113))
radiation effects on hydrogen agglomeration and diffusion in, 18: 26093
separation from aqueous acid solutions by solvent extraction using mixed aryl alkyl and diaryl esters of phosphoric acid, 18: 25625(P)
technology of, review on developments in, 18: 25949
tensile properties of fine wires of, 18: 25975 (NAEC-AML-1909)
vapor pressure of solid, at 905 to 1100°C, 18: 26014
BERYLLIUM ALLOYS
Be–Mo, diffusion and phase studies, 18: 26013
Be–Ni, phase studies, 18: 26005
Be–Zircaloy-2, hardness, 18: 25894(R) (NMI-2128)
Be–Zr, mechanical properties of splatcooled, 18: 25894(R) (NMI-2128)
BERYLLIUM CHLORIDE ETHERATES
reactions with aluminum chloride etherates, 18: 25431
$AlCl_3 \cdot (C_2H_5)_2O$–$BeCl_2 \cdot 2(C_2H_5)_2O$, phase studies and solubility, 18: 25431
BERYLLIUM COMPLEXES
with substituted 2-(pyridyl) and 2-(quinolyl)-1,3-indanediones, acid dissociation and formation constants of, 18: 25457
BERYLLIUM ISOTOPES Be-7
production by proton reactions in thick iron targets, cross sections for, 18: 26583
BERYLLIUM ISOTOPES Be-8
energy levels from deuteron capture by lithium-6, 25-Mev, 18: 26617
BERYLLIUM ISOTOPES Be-9
deuteron reactions (d,α), theoretical and experimental angular distributions, 18: 26675
helium-3 reactions (He-3,p) with, 18: 26549(R) (ORNL-3582(p.100-1))
proton reactions (p,2p) at 185 Mev, 18: 26567
proton reactions (p,n) at 4 to 14 Mev, neutron yield in, 18: 26601
BERYLLIUM ISOTOPES Be-10
nucleon interactions in, potentials for, 18: 26638
BERYLLIUM OXIDES
electric properties, 18: 26058
fabrication of compacts of, with increased resistance to radiation swelling, 18: 25965(P)
fabrication of, review on developments in, 18: 25949
wave functions for ground-state molecular, 18: 25364
BeO–UO_2, thermal conductivity at high fission depletion, effective in-pile, 18: 26073 (WAPD-246)
BERYLLIUM PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
BERYLLIUM SYSTEMS
Be–C–U, tensile properties of splatcooled, 18: 25894(R) (NMI-2128)
BETA DECAY
matrix elements in first-forbidden, 18: 26607
nuclear moments from, survey, 18: 26679
theory of forbidden, CVC, 18: 26526 (BNL-837(p.340-3))
BETA PARTICLES
carcinogenic effects on mouse skin, 18: 25081 (AHSB(RP)R-39(p.21-9))
crosslinking induced in PVA by, properties of product in, 18: 25488(T) (AEC-tr-6372(p.185-92))
crosslinking reactions in resin of maleic and phytic acids and propylene glycol induced by, 18: 25527(T) (AEC-tr-6372(p.533-8))
current density measurements on, using Faraday chamber, 18: 25830(T) (AEC-tr-6372(p.35-47))
detection and measurement of low-energy, device for, 18: 25853(P)
detection and measurement of, properties of organic-gel scintillators for, 18: 25864
dosimetry measurements using compensated calorimeter, 18: 25829(T) (AEC-tr-6372(p.29-34))
dosimetry of, in skin, 18: 25083 (AHSB(RP)R-39(p.44-68))
effects on atherosclerosis development in pigeons, 18: 25087(R) (TID-20641)
effects on benzene and its derivatives, ESR spectra of, 18: 25520(T) (AEC-tr-6372(p.481-90))
effects on color changes in acetone, ESR spectra of, 18: 25521(T) (AEC-tr-6372(p.491-2))
effects on crystal state and ESR spectra of polyethylene, 18: 25529(T) (AEC-tr-6372(p.547-54))
effects on cyclohexene, ESR spectra of uv effects on, 18: 25523(T) (AEC-tr-6372(p.495-8))
effects on cyclopentadiene, ESR spectra of free radicals produced in, 18: 25522(T) (AEC-tr-6372(p.493-4))
effects on mechanical properties of acetylated PVA, 18: 25489(T) (AEC-tr-6372(p.193-5))
effects on permeability of elastomers, 18: 25467 (AWRE-O-54/57)
effects on polyethylene ESR spectra of alkyl type radicals formed in, 18: 25533(T) (AEC-tr-6372(p.587-92))

effects on polyfluoroethylene and polydifluoroethylene, ESR spectra of radicals formed in, 18: 25531(T) (AEC-tr-6372(p.563-74))
effects on polyoxymethylene at low temperature, mechanism of, 18: 25514(T) (AEC-tr-6372(p.437-43))
effects on rat skin homograft survival, 18: 25112
effects on reactions between chlorine and sulfur compounds and polymers, 18: 25490(T) (AEC-tr-6372(p.197-205))
effects on spectra of ethylene glycol polymers at low temperature, 18: 25515(T) (AEC-tr-6372(p.445-53))
effects on 1-hexadecyne, ESR spectra of uv effects on, 18: 25524(T) (AEC-tr-6372(p.499-501))
energy dissipation distribution in lead and silver, effects of atomic weight on, 18: 26812(T) (AEC-tr-6372(p.11-15))
intensity of soft, above sea level, 18: 26102
lethal effects on chicken corneal cells, 18: 25169
polymerization effects on *cis*- and *trans*-vinylene monomers, 18: 25491(T) (AEC-tr-6372(p.207-12))
polymerization of styrene induced by, effects of diphenylpicrylhydrazine on, 18: 25486(T) (AEC-tr-6372(p.163-73))
polymerization of aniline, *p*-cresol, phenol, and phosphonitrile chloride induced by, 18: 25496(T) (AEC-tr-6372(p.261-72))
polymerization of acrylic acid induced by, ESR spectra of, 18: 25519(T) (AEC-tr-6372(p.473-80))
radiation dose measurements of, from gold-198 in animals after intraperitoneal injection, 18: 25071
telomerization of ethylene–isopropanol by, formation of amyl alcohol by, 18: 25511(T) (AEC-tr-6372(p.413-19))
transmission through aluminum, beryllium, and silver, backscattering from, 18: 26813(T) (AEC-tr-6372(p.17-28))

BETA SOURCES
therapeutic use of thallium-204 as, for eye inflammations in rabbits, 18: 25097(T) (JPRS-24936)
use for thin film thickness measurements, 18: 25769(P)

BETA SPECTROMETERS
stabilization of multichannel, digital methods for, 18: 25804 (NAS-NRC-Pub-1184(p.150-64))

BETA SPECTROSCOPY
analytical use, chemical, 18: 25303

BETATRONS
beam extraction, particle motion during, 18: 26179
materials testing with portable, x-ray, 18: 25677

BIBLIOGRAPHIES
on alpha radiolysis of aqueous solutions, 18: 25590
on analysis of uranium for trace impurities, 18: 25263 (AWRE/Lib/Bib/8)
on atmospheric tides and associated magnetic effects, 18: 26456
on bubble chamber applications and components, 18: 25778 (BNL-8083)
on cracking in high-strength steel weldments, 18: 25941 (DMIC-197)
on determination of trace amounts of cadmium, chromium, cobalt, iron, manganese, and molybdenum in uranium and uranium compounds, 18: 25272 (VDDIT-90)
on developments in radiation chemistry, 18: 25540
on ion cyclotron resonance in plasmas, 18: 26739
on ion exchange kinetics, 18: 25422
on ionospheric D layer, 18: 26457
on neutron scattering, 18: 26600
on plasma physics, 18: 26764
on properties and uses of calcium-47, 18: 25876 (ORNL-IIC-2)
on properties of refractory materials, 18: 26064(T)
on properties of solidified inert gases, 18: 25348
on radiation effects on solid uranium-based nuclear fuel materials, 18: 26072 (VDDIT-16(4.2))
on radiation sickness, 18: 25153
on radioactivation analysis, 18: 25310
on shock waves in plasma, 18: 26740
on thin-film superconductors, 18: 26476
on transportation of radioactive materials, 18: 25713 (VDDIT-89)

BILIRUBIN
content in lymph and serum of dogs, effects of Thorotrast on, 18: 25060

BIOCHEMISTRY
reaction kinetics in biological transmethylation, 18: 25061

BIOLOGICAL MATERIALS
radiation effects on membrane, ionizing, 18: 25106
radiation effects in, 18: 25105

BIOLOGICAL MODELS
for radiation survival curves for x-irradiated mammalian cells based on multi-target or multi-hit extrapolation, 18: 25171
of cell multiplication, 18: 26982(R) (NYO-2462-1)
of strontium metabolism in man, 18: 25073

BIOLOGICAL SYSTEMS
radiation effects in, parameters for multi-target and multi-hit survival curves in, 18: 25170
radioprotective compound testing using, 18: 25223

BIOLOGY
energy transfer in photodynamic reactions in cells and tissues, 18: 26983 (NYO-2734-1)

BIOMETRY
applications in studies of radiation effects on life span of dogs, 18: 25094(R) (UCD-472-109(p.173-7))
model for prediction of biological effects of atomic explosion, 18: 25722
use of sequential analysis in radiobiological research, 18: 25172

BIRDS
biological effects of mercury vapor exposure in pigeons, 18: 25057 (UR-645)
radiation effects on brain of, behavior resultant from proton, 18: 25099
radiation effects on development of atherosclerosis in pigeons, effects of dietary cholesterol levels on, 18: 25087(R) (TID-20641)

BISMUTH
charged particle reactions with, astatine isotope production in, 18: 26602
neutron elastic scattering at 0.5 to 0.8 Mev, cross sections for, 18: 26568
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26671
neutron scattering cross sections for, subthermal, 18: 26662
proton reactions (p,α) at 155 Mev, 18: 26629
radioinduced defects in, annealing of, 18: 26094
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374

BISMUTH ALLOYS
Bi–In, magnetic properties of superconducting, 18: 26495

BISMUTH FERRATES
$BiFeO_3$–$LaFeO_3$, atomic displacements and magnetic ordering in crystals of, 18: 25418(T)

BISMUTH FLUORIDES
additive effects on efficiency of fluoride volatility separation process for reactor fuels, 18: 26824(R) (ANL-6885)

BISMUTH ISOTOPES Bi-209
helium-4 fission at 70 Mev, energy-mass distributions in, 18: 26558 (UCRL-11377)
neutron scattering by, optical model calculations of cross sections for, 18: 26663
neutron separation energy for, 18: 26576
proton reactions (p,n) and (p,2n) with, polonium-210 production in, 18: 26647

BISMUTH NITRATES
separation by reversed phase partition chromatography using organophosphorus compounds, 18: 25614

BITUMINOUS MATERIALS
use in waste fixation, 18: 26980(P)

BLADDER
radiotherapy of cancer of urinary, using massive doses of gamma radiation, 18: 25244

BLOOD
effects of loss of, in irradiated mice, 18: 25116
erythropoietin content in, effects of anemia and other factors on, in man and animals, 18: 26988 (TID-20635)
radiation effects on enzyme activity in rat, 18: 25154

BLOOD CIRCULATION
cerebral, tracer measurements of, 18: 25043
in heart of dogs, tracer study on effects of anesthesia on, 18: 25040
in heart of man and dogs, measurement of, using krypton-85 as tracer, 18: 25042
through dog skin, krypton-85 measurement of, 18: 25070
tracer studies in isolated perfused rat heart, using rubidium-86 as tracer of buffer distribution, 18: 25041

BLOOD DISEASES
distribution of hematopoietic marrow in, demonstrated by radioisotope scanning, 18: 25238
BLOOD PICTURE
radiation effects on, in starch-injected and normal parabiotic rabbits, 18: 25150
radiation effects on human, 18: 25174
BLOOD SERUM
bilirubin content of, effects of Thorotrast on, in dogs, 18: 25060
protective effects of transfusions of, against radiation injuries in guinea pigs, 18: 25230
radiation effects on protein content of, in rats, 18: 25140
radiation effects on iron in rabbit, x, 18: 25164
BLOOD VESSELS
atherosclerotic lesions in, effects of radiation and dietary cholesterol levels in pigeons, 18: 25087(R) (TID-20641)
radiation intensity variations in, studies of method for measuring, 18: 25051
BODY WATER
circulation in radiation-damaged gastrointestinal tract in rats, 18: 25155
BOILERS
design of, for power plants with gas cooled reactors, 18: 26941
BOILING
burnout heat transfer in fog-cooled 19-rod fuel element, 18: 26900 (HW-80523(Rev.1))
heat transfer in, surface parameters affecting, 18: 25670
nucleate pool, mechanism of saturated, 18: 25671
superheat in cryogenic nucleate, 18: 26461
BOILING REACTOR EXPERIMENTS
fuel element development and fabrication for superheated Borax-V, 18: 26894(R) (ANL-6868(p.109-16))
fuel element testing for superheated Borax-V, 18: 26898(R) (ANL-6868 (p.188-9))
operations of Borax-V, 18: 26824(R) (ANL-6885)
BOILING REACTORS
design of fail-safe, 18: 26890(P)
design of Gundremmingen, 18: 26932
design with horizontal fuel rods, 18: 26953(P)
fuel element assembly design for, 18: 26952(P)
heat transfer analysis of light-water forced-circulation, using superheating at subcritical pressure, 18: 26945
reactivity effects of voids in, critical assembly study of, 18: 26884
reactivity variation due to random boiling in, minimization of, 18: 26924(R) (EURAEC-1065)
use of gas turbines as heat, 18: 26942
BOLOMETERS
design and performance for measuring plasma energy losses, 18: 26779
design and performance of bismuth, collodion, and germanium, 18: 26780
BONDS
length of hydrogen-oxygen, isotopic substitution effects on, 18: 25417(T)
BONE MARROW
analysis, 18: 25048
desoxyribonucleic acid synthesis in rat, effects of x radiation and radiomimetic drug on, 18: 25166
desoxyribonucleic acid synthesis in rat, effects of x radiation and radiomimetic drug on, 18: 25173
distribution of hematopoietic, in patients with blood dyscrasias or cancer, radioisotope scanning of, 18: 25238
fast neutron absorption dose in, 18: 25048
proliferation of spleen by transplanted cells of, in irradiated mice, 18: 25189
protective effects of transfusions of, against radiation injuries in guinea pigs, 18: 25230
radiosensitivity, 18: 25241
radiosensitivity of, effects of chemical content on, 18: 25048
thorium dioxide deposits in human, microscopic recognition of, 18: 25076
transfusions, effects on results of tumor therapy with radiation or chemicals, 18: 25220
transplantation of, in mice, effects of irradiation of donor cells on survival and chromosome aberrations in recipients following, 18: 25201
BONES
radiation dose to, in children from iodine-131 and strontium-90 in milk, 18: 25727
strontium-90 content of, collected in Great Britain, 1963, 18: 25735
BORIC ACID
effects on heat treatment and radiation effects on PVA, 18: 25487(T) (AEC-tr-6372(p.175-84))
BORON
additive effects on niobium oxidation, 18: 25936
additive effects on electric conductivity, hardness, and structure of niobium, 18: 25999
determination in plutonium, oxalate separation for spectrophotometric, 18: 25266 (HW-28529)
determination of, methods for titrimetric, 18: 25276
order in calcium boron silicates, 18: 25366
preparation and properties of, book on, 18: 25905
production by fusion electrolysis, 18: 25913(P)
BORON FLUORIDES
boron-10 and -11 exchange between, and boron trifluoride complexes with 1- and 2-butene, 18: 25341
BORON ISOTOPES B-10
exchange reactions between boron trifluoride and boron trifluoride complexes with 1- and 2-butene at low temperatures, 18: 25341
proton reactions (p,2p) at 185 Mev, 18: 26567
BORON ISOTOPES B-11
deuteron reactions (d,$n\gamma$) at 1.0 and 0.7 Mev, neutron-gamma angular correlations, 18: 26680
exchange reactions between boron trifluoride and boron trifluoride complexes with 1- and 2-butene at low temperatures, 18: 25341
proton inelastic scattering at 150 Mev, unified boron-11 model in, 18: 26614
proton reactions (p,2p) at 185 Mev, 18: 26567
proton reactions (p,n) at 4 to 14 Mev, neutron yield in, 18: 26601
proton reactions (p,n), resonances in, 18: 26672
spectra in calcium boron silicates, NMR, 18: 25366
BORON ISOTOPES B-12
energy levels of, shell model LS coupling, 18: 26624
BORON OXIDES
B_2O_3–Cs_2O, radiation effects on ESR spectra of, 18: 26079
B_2O_3–KF–KBF_4–K_2ZrF_6, electric conductivity, 18: 25432
B_2O_3–K_2O, radiation effects on ESR spectra of, 18: 26079
B_2O_3–Li_2O, radiation effects on ESR spectra of, 18: 26079
B_2O_3–Na_2O, radiation effects on ESR spectra of, 18: 26079
B_2O_3–Rb_2O, radiation effects on ESR spectra of, 18: 26079
BORON SYSTEMS
B–C–rare earths, phase studies, 18: 25319 (COO-1140-103)
BOROSILICATE GLASS
electric discharge thermal shock effects on, 18: 26806
BOSONS
effects of charged-vector, on photon propagators, 18: 26338
interactions with photons in quantum electrodynamics, Feynman diagram for, 18: 26419
interactions with nucleons, isobar production in, 18: 26358
interactions with impurities in gases of, dynamics of, 18: 26406
mixtures of, application of Boguliubov transformation to, 18: 26436
production of intermediate vector (W^2), by neutrinos, 18: 26268 (BNL-837(p.249-56))
production of intermediate vector (W), in neutrino reactions with nuclei, 18: 26269 (BNL-837(p.257-65))
production of W, in neutrino interactions, 18: 26266 (BNL-837 (p.160-9))
use of intermediate vector (W), in weak-interaction models, 18: 26270 (BNL-837(p.266-74))
BRAIN
blood circulation in, tracer measurements of, 18: 25043
effects of radiation sickness on ascorbic acid content in dog, 18: 25161
radiation effects on bird, proton, 18: 25099
BRAIN TUMORS
radiodiagnosis of, development of scintillation camera for, 18: 25236
BRAZED JOINTS
inspection of copper, using heat-pulse method, 18: 26824(R) (ANL-6885)
BREEDER REACTORS
corrosion and nuclear fission reactions in, 18: 25924

review, 18: 26940
BREMSSTRAHLUNG
cross section calculations for electron and positron, 18: 26380
energy measurements at 15 to 80 Mev by cascade curves, calorimetry, and quantum meter method, 18: 25861
reactions (γ,π^+) of polarized, at 227 to 373 Mev, 18: 26382
reactions with aluminum-27 at 150 to 720 Mev, 18: 26589
reactions with carbon-12 at 150 to 720 Mev, 18: 26589
reactions with copper at 150 to 720 Mev, 18: 26589
BRITTANY POWER REACTOR (EL-4)
fuel preparation for, uranium(IV) oxide, 18: 25343
fuel preparation for, uranium (IV) oxide, 18: 25900
BROMINE
diffusion in irradiated uranium fuel elements, 18: 26903
recoil chemistry in 1-bromobutane and 1-bromopropane, 18: 25596
BROMINE IONS
distribution coefficients in lithium chloride ion exchange systems, 18: 25297
BROMINE ISOTOPES Br-80
isomeric transition in organic systems, chemical effects, 18: 25596
BROMINE ISOTOPES Br-81
alpha scattering by, Coulomb excitation from, 18: 26552(R) (ORNL-3582(p.112-14))
neutron reactions (n,γ) in organic systems, chemical effects, 18: 25596
BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
information processing systems development at, 18: 25743 (NAS-NRC-Pub-1184(p.36-7))
BUBBLE CHAMBERS
bibliography on applications and components, 1950 to April 1964, 18: 25778 (BNL-8083)
neutrino interactions in Freon, 18: 26265 (BNL-837(p.114-36))
BUBBLES
diffusion of fission, in solids, 18: 26069(R) (ANL-6868(p.373-417))
growth in saturated nucleate pool building, 18: 25671
release and swelling in solids, model for, 18: 26080
BUILDING MATERIALS
development for power generation, 18: 26946
development of, conference on, 18: 25907
stress analysis of filament-wound laminated shells, 18: 26115 (SCL-TM-64-53)
BUTADIENE
radioinduced graft polymerization on celluloses, properties of product in, 18: 25477(T) (AEC-tr-6372(p.103-8))
radioinduced graft polymerization on PVA, effects of heat treatment on, 18: 25482(T) (AEC-tr-6372(p.135-40))
radioinduced graft polymerization on polyethylene, 18: 25484(T) (AEC-tr-6372(p.145-57))
radiolysis of, spectral studies on uv, 18: 25588
acrylonitrile–butadiene, product composition in radioinduced graft polymerization with cellulose, 18: 25480(T) (AEC-tr-6372(p.125-7))
acrylonitrile–butadiene, radioinduced graft polymerization on celluloses, 18: 25479(T) (AEC-tr-6372(p.117-23))
acrylonitrile–butadiene, radioinduced graft polymerization on PVA, 18: 25482(T) (AEC-tr-6372(p.135-40))
acrylonitrile–butadiene, structural effects in radioinduced graft polymerization on celluloses, 18: 25481(T) (AEC-tr-6372(p.129-34))
butadiene–styrene, radioinduced graft polymerization on celluloses, 18: 25478(T) (AEC-tr-6372(p.109-15))
butadiene–styrene, radioinduced graft polymerization on PVA, 18: 25482(T) (AEC-tr-6372(p.135-40))
butadiene–styrene, radioinduced graft polymerization on polyethylene, 18: 25484(T) (AEC-tr-6372(p.145-57))
butadiene–styrene, structural effects in radioinduced graft polymerization on celluloses, 18: 25481(T) (AEC-tr-6372(p.129-34))
BUTADIENE, CHLORO- POLYMERS
radioinduced polymerization on polyethylene, 18: 25484(T) (AEC-tr-6372(p.145-57))
1,3-BUTADIENE, 2-METHYL-
radioinduced polymerization on polyethylene, 18: 25484(T) (AEC-tr-6372(p.145-57))
radiolysis of, spectral studies on gamma, 18: 25588
BUTANE
molecular dissociation and ionization of, statistical model for, 18: 26204
BUTANE, 1-BROMO-
bromine recoil chemistry in, from bromine-80 isomeric transition, 18: 25596
BUTANE, 1-CHLORO-
radiolysis, x, 18: 25598
BUTANE, 2-CHLORO-
radiolysis, x, 18: 25598
BUTANE, 2-METHYL-
yields in gamma, radiolysis of squalane at −196 to 350°C, 18: 25551
1,3-BUTANEDIONE, 1-PHENYL- COMPLEXES
with europium, laser properties of, 18: 25445
1,3-BUTANEDIONE, 1-PHENYL-4,4,4-TRIFLUORO-
complexes with europium, laser properties of, 18: 25445
1-BUTANOL
additive effects on radioinduced graft polymerization of polypropene to acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, 18: 25505(T) (AEC-tr-6372(p.363-9))
effects on ion exchange of uranium and other elements in system with organic acids, 18: 25305
effects on radioinduced graft polymerization of celluloses on styrene, 18: 25474(T) (AEC-tr-6372(p.83-8))
radiolysis of, free radical yields in gamma, 18: 25538
solvent properties for zirconium complexes with Alizarin S, 18: 25306
2-BUTANONE, 4-PHENYL-
complexes with lanthanum, neodymium, praseodymium, and yttrium, stability of, 18: 25389
1-BUTENE
complexes with boron trifluoride, boron-10 and -11 exchange between, and gaseous boron trifluoride at low temperatures, 18: 25341
radiolysis of, spectral studies on uv, 18: 25588
2-BUTENE
complexes with boron trifluoride, boron-10 and -11 exchange between, and gaseous boron trifluoride at low temperatures, 18: 25341
radiolysis of, spectral studies on gamma, 18: 25588
2-BUTENE, 2-METHYL-
radiolysis of, spectral studies on gamma, 18: 25588
BUTYL PHOSPHATES
complexes with neodymium nitrates in aqueous solutions, spectra of, 18: 25393
solvent properties for americium and europium, 18: 25622
solvent properties for monazite rare earths from nitric acid solutions, cascade equilibria for, 18: 25624
use in reversed-phase partition chromatography of chlorides, nitrates, and perchlorates, 18: 25614
uses in radiochemical separations, evaluation of n-paraffin mixtures as diluent for, 18: 25605 (DP-882)
CaBr–TBP, solvent properties for cobalt, copper, manganese, nickel, and zinc, 18: 25382
HBr–TBP, solvent properties for cobalt, copper, manganese, nickel, and zinc, 18: 25382
$HClO_4$–TBP, solvent properties for europium, lanthanum, and ytterbium, 18: 25381
LiBr–TBP, solvent properties for cobalt, copper, manganese, nickel, and zinc, 18: 25382
$Nd(NO_3)_3$–TBP–H_2O, complex formation in, 18: 25393

C

CABLES
electric insulation for, screening and transmission properties of mineral, at .01 to 100 Mc at 400°C, 18: 26830 (AEEW-M-369)
CADARACHE REACTORS (RAPSODIE)
critical parameters of, studies in ZPR-III, 18: 26824(R) (ANL-6885)
CADMIUM
determination in trace amounts in uranium and uranium compounds, 18: 25272 (VDDIT-90)
electron backscattering at 8 to 22 Mev, 18: 26216
melting temperature of, equations for calculating, 18: 25990
neutron elastic scattering at 0.5 to 0.8 Mev, cross sections for, 18: 26568
radiation effects on electrodes of, gamma, 18: 26067(R) (AI-8971)

separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
CADMIUM ALLOYS
Cd–In–Ag, radiation effects on microstructure, 18: 26897(R) (ANL-6868 (p.175-87))
Cd–La, heat of formation of stoichiometric, 18: 26824(R) (ANL-6885)
CADMIUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
CADMIUM COMPLEXES
with dialkyl phosphoric acids, preparation and properties, 18: 25429
CADMIUM ISOTOPES Cd-110
oxygen-16 scattering by, Coulomb excitation from, 18: 26551(R) (ORNL-3582(p.107-11))
CADMIUM ISOTOPES Cd-112
oxygen-16 scattering by, Coulomb excitation from, 18: 26551(R) (ORNL-3582(p.107-11))
CADMIUM ISOTOPES Cd-114
oxygen-16 scattering by, Coulomb excitation from, 18: 26551(R) (ORNL-3582(p.107-11))
CADMIUM ISOTOPES Cd-116
oxygen-16 scattering by, Coulomb excitation from, 18: 26551(R) (ORNL-3582(p.107-11))
CADMIUM NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
CADMIUM PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
CADMIUM SULFIDES
radiation induced lattice defect formation in, gamma-, 18: 26088
CALCINATION
safety analysis of ICPP facility for, 18: 26977 (IDO-14620)
CALCIUM
content in Indian vegetables, 18: 25067
melting temperature of, equations for calculating, 18: 25990
proton elastic scattering at 180 Mev, strong absorption model for, 18: 26562
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
sorption on quartz, measurements by ion-exchange membrane electrodes, 18: 25327 (RT/GEO(64)-1)
CALCIUM BOROSILICATES
boron-11 NMR spectra in, 18: 25366
CALCIUM CARBONATES
carbon-13/carbon-12 and oxygen-18/oxygen-16 ratios in, from Pleistocene varved clays in Toronto, Canada, 18: 25695
CALCIUM CHLORIDES
oxidation to perchlorate, equipment and method for anodic, 18: 25386
$CaCl_2$–KCl, vapor pressure, 18: 25435
CALCIUM FLUORIDES
erbium ion spectrum in, trivalent, 18: 25359
gadolinium ion EPR spectra in, 18: 25416(T)
radiation induced color centers in samarium-doped, with yttrium impurities, 18: 26086
radioinduced luminescence in thulium-doped, gamma, 18: 25571(T)
reactions of dysprosium in, photochemical and thermal, 18: 25599
CALCIUM ISOTOPES Ca-40
meson (μ^-) capture, coupling constants in, 18: 26523 (BNL-837(p.292-7))
meson (μ^-) reactions, 18: 26525 (BNL-837(p.315-23))
proton reactions (p,2p) at 185 Mev, 18: 26567
CALCIUM ISOTOPES Ca-47
production and uses, 18: 25876 (ORNL-IIC-2)
CALCIUM MOLYBDATES
$CaMoO_4$–$DyNbO_4$, fluorescence spectra, 18: 26017
$CaMoO_4$–$DyNbO_4$, preparation and spectra of, 18: 26017
$CaMoO_4$–$ErNbO_4$, preparation and spectra of, 18: 26017
$CaMoO_4$–$EuNbO_4$, preparation and spectra of, 18: 26017
$CaMoO_4$–$GdNbO_4$, preparation and spectra of, 18: 26017
$CaMoO_4$–$HoNbO_4$, preparation and spectra of, 18: 26017
$CaMoO_4$–$NdNbO_4$, preparation and spectra of, 18: 26017
$CaMoO_4$–$PrNbO_4$, preparation and spectra of, 18: 26017
$CaMoO_4$–$SmNbO_4$, fluorescence spectra, 18: 26017
$CaMoO_4$–$SmNbO_4$, preparation and spectra of, 18: 26017
$CaMoO_4$–$TbNbO_4$, preparation and spectra of, 18: 26017
$CaMoO_4$–$TmNbO_4$, preparation and spectra of, 18: 26017
$CaMoO_4$–$YbNbO_4$, preparation and spectra of, 18: 26017
CALCIUM OXIDES
determination in cements by x-ray fluorescence, 18: 25275
CaO–CoO–V_2O_5–ZnO, analysis by x-ray fluorescence, 18: 25275
CaO–Cr_2O_3–Fe_2O_3, analysis by x-ray fluorescence, 18: 25275
CALCIUM TUNGSTATES
$CaWO_4$–$CeNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$DyNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$ErNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$EuNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$GdNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$HoNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$LaNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$LuNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$NdNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$PrNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$SmNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$TbNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$TmNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$YbNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
$CaWO_4$–$YNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
CALIFORNIUM ISOTOPES Cf-252
fission of, tritium production in spontaneous, 18: 26644
CALORIMETERS
performance of compensated, for beta dosimetry, 18: 25829(T) (AEC-tr-6372(p.29-34))
CAMBRIDGE SYNCHROTRON
description, 18: 26168 (CONF-401-2)
CAMERAS
efficiency of multiplate proton, 18: 25866
CARBAMIC ACID, DIMETHYLDITHIO-, SALTS
preparation of sulfur-35-labeled sodium, 18: 25460
CARBAMIC ACID, METHYLDITHIO-
preparation of sulfur-35-labeled sodium salts of, methods for, 18: 25461
CARBON
additive effects on uranium crystal structure, 18: 25269(R) (NLCO-905)
additive effects on oxidation of plutonium–uranium alloys, 18: 26893(R) (ANL-6868(p.11-108))
deuteron scattering by, cross sections for, 18: 26560
impregnation with molten metal, 18: 25957(P)
neutron elastic scattering at 5.0 Mev, angular distribution, 18: 26668
neutron scattering by, dose measurements in small-volume, 18: 26532 (NAA-SR-9418)
neutron scattering cross sections at 0.5 to 0.8 Mev, 18: 26571
proton elastic scattering at 180 Mev, strong absorption model for, 18: 26562
reactions with rare earth borides, 18: 25319 (COO-1140-103)
solubility in liquid sodium, 18: 26824(R) (ANL-6885)
CARBON DIOXIDES
corrosive effects on iron–uranium carbide systems, 18: 26059

corrosive effects on stainless steel at 650 to 800°C, 18: 26096
corrosive effects on graphite, 18: 26095
determination in aqueous solutions by gas chromatography, 18: 25273(T) (AEC-tr-6227/1(p.9-14))
electron emission by solid, secondary, 18: 26156
formation in radiolysis of polyoxymethylene at low temperature, mechanism of, 18: 25514(T) (AEC-tr-6372(p.437-43))
ionization potential, 18: 25345
oxidative effects on tantalum at 700 to 950°C, 18: 25935
radiolysis of aqueous solutions of, reactions of hydrated electron in, 18: 25579

CARBON IONS
ionization of argon by 8 to 100 kev, 18: 26217
scattering by butane, dissociation and ionization from, 18: 26204

CARBON ISOTOPES C-12
content in ratio with carbon-13 in calcium carbonate Pleistocene varved clays from Toronto, Canada, 18: 25695
deuteron elastic scattering at 10 Mev, angular distributions for, 18: 26561
energy levels of, shell model LS coupling, 18: 26624
gamma reactions (γ,p) at 20 to 22 Mev, cross section resonances, 18: 26674
meson (μ^-) capture, coupling constants in, 18: 26523 (BNL-837(p.292-7))
neutron elastic and inelastic scattering at 14.1 Mev, 18: 25600
neutron elastic scattering by, cross sections at 17 to 21 Mev, 18: 26547(R) (ORNL-3582(p.93-4))
photon reactions at 150 to 720 Mev, 18: 26589
reactions (^{12}C,f) with ytterbium-174 at 109 and 125 Mev, energy-mass distributions in, 18: 26558 (UCRL-11377)
scattering by nuclei, strong absorption model for elastic, 18: 26563

CARBON ISOTOPES C-13
content in ratio with carbon-12 in calcium carbonate Pleistocene varved clays from Toronto, Canada, 18: 25695

CARBON ISOTOPES C-14
determination in amino acids, using scintillating organic anion exchange resin, 18: 25259 (NYO-10405)
determination in loess soils of Russian Steppe, 18: 25685
determination in organic materials by radiometric methods, 18: 25293
determination of, efficiency use of glass fibers for liquid scintillation, 18: 25839
deuteron reactions (d,γ) at 1.0 to 2.0 Mev, evidence for, 18: 26682
distribution in chemical products of N(n,p) ^{14}C reactions in acetylhydrazide, 18: 25556
energy separation and nuclear-force charge dependence in, isobaric-triplet, 18: 26618
helium-3 reactions (He-3,α) and (He-3,d) with, 18: 26549(R) (ORNL-3582(p.100-1))
skin dose calculations for, 18: 25083 (AHSB(RP)R-39(p.44-68))
uptake and transfer by leaves in linden tree, 18: 25058(T) (OTS-63-11008 (p.1-5))

CARBON ISOTOPES C-15
half life, 18: 26682

CARBON MONOXIDES
disproportionation reaction of, catalytic effects of barium and cesium on, 18: 25321 (GA-5215)
electron-capture cross sections at 0.4 to 3.6 kev, 18: 26229
formation in radiolysis of polyoxymethylene at low temperature, mechanism of, 18: 25514(T) (AEC-tr-6372(p.437-43))
radiolysis of aqueous solutions of, reactions of hydrated electron in, 18: 25579
reactions with beryllium at 1000 to 1500°C, kinetics and products of, 18: 25328(R) (SC-DC-64-864)
reactions with liquid sodium, 18: 26824(R) (ANL-6885)
reduction of rare earth sulfates by, 18: 25427

CARBON STEEL
corrosion by water and steam at 300 and 400°C, effects of surface treatment on, 18: 25922(T) (EURAEC-1038)
mechanical properties at high pressures and temperatures, 18: 25972 (ASD-TDR-63-90(Vol.II))
properties of, effects of uranium on, 18: 26044

CARBON SULFIDES
effects on yields in radiolysis of α- and p-toluenethiol, 18: 25549
CS_2–S–toluene, radiolysis of, formation of sulfur compounds in, 18: 25547

CARBON SYSTEMS
B–C–rare earths, phase studies, 18: 25319 (COO-1140-103)
Be–C–U, tensile properties of splatcooled, 18: 25894(R) (NMI-2128)
C–Fe, mechanical properties at high pressures and temperatures, 18: 25972 (ASD-TDR-63-90(Vol.II))
C–Fe, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
C–Fe–O, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
C–Np–U, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
C–Ta, phase studies, 18: 26000
C–U, production of dense, using iron additions, 18: 25963(P)
C–U–Zr, phase studies, 18: 25269(R) (NLCO-905)

CARBON TETRACHLORIDE
effects on hydrogen yields in radiolysis of liquid ethanol, 18: 25589
luminescence quenching by, in p-terphenyl–benzene and -cyclohexane solutions, 18: 25563

CARBONATE COMPLEXES
with europium and neodymium, ion exchange studies, 18: 25438

CARBONYL SULFIDE
magnetic resonance of, rotational, 18: 26422
scattering by butane, dissociation and ionization from, 18: 26204

CARCINOGENESIS
radioinduced, review, 18: 25211

CARCINOMAS
of cervix, radium therapy of, effects of halothane anesthesia on, 18: 25118
radioinduced by low radiation doses, review of studies on, 18: 25149
radiotherapy of cervical, complications after, 18: 25167
radiotherapy of laryngeal, dose-time relations for, 18: 25250
radiotherapy of lung, sequelae of, alone and combined with surgery, 18: 25252
radiotherapy of, protective effects of phenylbutazone in, gamma, 18: 25243

CARDIOGRAPHY
of rabbit heart, as index to radiation injuries, 18: 25109

CAROLINAS-VIRGINIA TUBE REACTOR
power distributions and control rod worths in, 18: 26863 (CVNA-134)

CAROTENOIDS
radiation effects on flour, gamma, 18: 25139

CASEIN
radiation effects, gamma, 18: 25469 (SRIA-120)
radioinduced graft polymerization of acrylonitrile and styrene on, 18: 25469 (SRIA-120)

CATALASES
effects on radiosensitivity of bean roots, 18: 25183
radiation effects on activity of, in blood serum in rats, 18: 25154

CATALYSTS
properties of chromia-impregnated alumina, for spin conversion of ortho-hydrogen and para-deuterium, 18: 25442
properties of radiation as, 18: 25872
radiation effects on aluminum oxide, 18: 25468 (BNL-845)

CATARACTS
radioinduced in rabbits, x, 18: 25195
radioinduced, effect of dose fractionation on, 18: 25200

CATHODE-RAY TUBES
development of three-dimensional display, 18: 25748 (NAS-NRC-Pub-1184(p.320-1))

CATHODES
behavior in gas discharges, intrinsic, 18: 26164
heating of, using polonium-210, 18: 25870 (MLM-1154)

CATIONS
separation by thin-layer ionophoresis, tracer techniques in, 18: 25612(T) (ORNL-tr-128)

CATTLE
radiation dose to gastrointestinal tract in, from ingested insoluble radioisotopes, 18: 25142
radiation effects on testicles of bulls, 18: 25185
radioactivity of Arctic, effects of fallout fission products on, 18: 25055 (NP-13985)

CAVES
air circulation in, 18: 25718
design of Chemistry Division at Argonne, 18: 25641
design of special features in modern, 18: 25641
remote-control manipulator design for, 18: 25644
CAVITY RESONATORS
design of 240-Mev electron-positron storage ring, 18: 26158
molecular interactions with electromagnetic field, quantum electrodynamics of, 18: 26399
CELLULOSE
radioinduced graft polymerization with acrylonitrile–butadiene and acrylonitrile–styrene, product composition of, 18: 25480(T) (AEC-tr-6372(p.125-7))
CELLULOSES
radioinduced graft polymerization on styrene, solvent effects on, 18: 25474(T) (AEC-tr-6372(p.83-8))
radioinduced graft polymerization on styrene, effects of chemical treatment, pretreatment, and refining on reactivity of, 18: 25475(T) (AEC-tr-6372(p.89-96))
radioinduced graft polymerization of acrylonitrile and styrene on viscose rayon, solvent effects on, 18: 25476(T) (AEC-tr-6372(p.97-102))
radioinduced graft polymerization on butadiene, properties of product in, 18: 25477(T) (AEC-tr-6372(p.103-8))
radioinduced graft polymerization on butadiene–styrene systems, rate of, 18: 25478(T) (AEC-tr-6372(p.109-15))
radioinduced graft polymerization on acrylonitrile–butadiene, rate of, 18: 25479(T) (AEC-tr-6372(p.117-23))
radioinduced graft polymerization on acrylonitrile–butadiene and butadiene–styrene, structural effects on, 18: 25481(T) (AEC-tr-6372(p.129-34))
CEMENTS
analysis by x-ray fluorescence, 18: 25275
mixing raw materials for, tracer studies of efficiency of 1000-m^3 silo for, 18: 25871 (SGAE-IB/IA-1/1964)
CENTRIFUGAL PUMPS
design of voluteless, 18: 25673(P)
CERAMIC INSULATORS
electric properties, 18: 26058
CERAMIC MATERIALS
elastic constants of, vibration method for determining, 18: 25679
mechanical properties of, effects of electronic structure on, 18: 25973 (ASD-TDR-63-605(Pt.II))
thermal conductivity of porous sintered, 18: 25987(T) (NP-tr-1247)
CERIUM
determination in cerium carbonate and monazite sand using potassium dichromate, potentiometric, 18: 25308
determination in presence of iron and vanadium using potassium dichromate, potentiometric, 18: 25308
determination in pure salts using sodium molybdate, titrimetric, 18: 25287
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
magnetic moment of ions of, in crystalline state and in solution, 18: 25350
neutron elastic scattering at 5.0 Mev, angular distribution, 18: 26668
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26668
precipitation using adipic, malonic, phthalic, and succinic acids, 18: 25351
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
separation from scandium by cation exchange chromatography, 18: 25613
CERIUM CARBIDES
crystal structure, 18: 25970(R) (ANL-6868(p.303-25))
CERIUM CARBONATES
analysis for cerium using potassium dichromates, potentiometric, 18: 25308
CERIUM CHLORIDES
complexes with 1,10-phenanthroline, structure and thermal stability of, 18: 25387
CERIUM FLUORIDES
laser emission by, containing trivalent neodymium ion, 18: 26119
CERIUM HYDRIDES
electric conductivity, 18: 25363
CERIUM IONS
yield of, in radiolysis of cerium sulfates, 18: 25590
CERIUM ISOTOPES Ce-142
alpha decay of, energies and rates for, 18: 26640
CERIUM ISOTOPES Ce-144
determination in soil, 18: 25265 (HASL-143)
determination in vegetation, 18: 25265 (HASL-143)
CERIUM NIOBATES
$CaWO_4$–$CeNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
CERIUM OXIDES
reactions with uranium dioxides, 18: 26896(R) (ANL-6868(p.133-74))
CESIUM
angular distributions of excited, in cesium ion sorption on molybdenum, 18: 26233(T)
catalytic effects on carbon monoxide disproportionation reaction and on steam–graphite reaction, 18: 25321 (GA-5215)
corrosive effects on materials for in-pile thermionic cells, 18: 26259
melting temperature of, equations for calculating, 18: 25990
mobilities of cesium ions in, by pulsed-discharge technique, 18: 26103 (AROD-3588:2)
neutron capture by, gamma spectra and giant resonances in, 18: 26611
performance in thermionic cells, 18: 26933
preparation and properties of, book on, 18: 25905
sorption by ammonium phosphomolybdates, mechanism of, 18: 25378
sorption from natural waters by earth materials, Cape Thompson, Alaska, 18: 25688 (TID-20638)
vapor dispenser for, 18: 25759
CESIUM BROMIDES
CsBr–TBP, solvent properties for cobalt, copper, manganese, nickel, and zinc, 18: 25382
CESIUM IONS
mobilities in cesium vapor by pulsed-discharge technique, 18: 26103 (AROD-3588:2)
sorption on molybdenum, emission of excited cesium atoms in, 18: 26233(T)
CESIUM ISOTOPES Cs-134
production by fission reactions in plutonium and uranium isotopes, cross sections for isomeric pair, 18: 26585
CESIUM ISOTOPES Cs-137
biological half life of, effects of diet on, in man, 18: 25687 (NP-13981)
content in Finnish Lapps, 1962 to 1964, 18: 25710 (NP-13984)
content in man and diet in southern Finland, 1961 to 1964, 18: 25687 (NP-13981)
distribution in food chains of, in Arctic regions, 18: 25055 (NP-13985)
uptake by biological organisms in fresh-water pond, 18: 25079
uptake by man, 18: 25693
CESIUM MANGANESE FLUORIDES
magnetic properties, 18: 26159
CESIUM OXIDES
B_2O_3–Cs_2O, radiation effects on ESR spectra of, 18: 26079
CESIUM URANYL NITRATES
radiation effects on fluorescence spectra of uranyl ion in, 18: 25554
CHALCONE
naringin dihydro-, deuterium–hydrogen exchange in alkaline solution of, 18: 25453
CHARGED PARTICLE BEAMS
deflection of, magnetic system for, 18: 26185(P)
electromagnetic field excitation by, in accelerator cavities, calculation of, 18: 26181
focusing of, calculation of two-quadrupole magnet system for, 18: 26178
interactions with nonhomogeneous plasma, oscillations from, 18: 26781
profile of, equations for normalized, 18: 26172
CHARGED PARTICLES
acceleration by d-c potentials, 18: 26182(P)
diffusion into plasma in reflection discharge, 18: 26782
energy losses in magnetoactive plasma, 18: 26791
energy losses in piezoelectric crystals by coupling of electric and elastic fields, 18: 26370
escape from plasma in magnetic bottle, 18: 26799
identification using solid-state detectors, 18: 25794 (NAS-NRC-Pub-1184

(p.96-103))
motion during beam extraction, 18: 26179
motion in dipole magnetic field, glow discharge experiments on area of, 18: 26117(T) (JPRS-23767(p.57-61))
motion in magnetic field, equations for nonrelativistic, 18: 26147
motion in magnetic mirrors, 18: 26702(T) (AEC-tr-5589(p.637-77))
movement in magnetic field, energy dissipation in, 18: 26128
movement in Van Allen belts, adelphic-integral method and Stoerner problem in, 18: 26242
oscillations in cyclic accelerators, 18: 26180
production from interactions of cosmic fragments with heavy nuclei of energy greater than 1000 Bev, 18: 26378
radiation emission from, in flight in a round waveguide, 18: 26150
radiation emission by moving, with variable charge, 18: 26296
radiation from relativistic, in laminated media, 18: 26297
reactions with nuclei, Coulomb distortions in neutron stripping, 18: 26646
reactions with quantized plasma, energy transfer in, 18: 26749
scattering of spinless, by even-even nuclei, optical model calculations, 18: 26678

CHEMICAL ANALYSIS
methods used at ORNL, indexes to master manual of, 18: 25271 (TID-7015(Indexes)(Rev.1))

CHEMICAL ENGINEERING
book: *The Theory of Recycle Processes in Chemical Engineering*, 18: 25647(T)

CHEMICAL PROPHYLAXIS
effects of phenylbutazone during gamma therapy, 18: 25243

CHEMICAL RADIATION DETECTORS
review, 18: 25844

CHEMICALS AND REAGENTS
photodynamic properties, 18: 26983 (NYO-2734-1)

CHEMOTHERAPY
effects of semicarbazide-cadmium, on malignant tumors in man, 18: 25054

CHICKENS
radiation effects on oxygen consumption by embryonic intestine of, 18: 25124
radiation effects on respiratory activity in normal and tumor tissues of, 18: 25168
radiation effects on corneal cells of, 18: 25169

CHLORIDE IONS
activity in ion exchange resin, determination by invasion correction function, 18: 25297
transfer from water to heavy water, calculation of free energy of, 18: 25338

CHLORINE
isotopic exchange between tetramethylammonium chloride and substituted phosphoryl chlorides, 18: 25441
reactions with irradiated ethylene, propene, styrene, and vinyl alcohol polymers and nylon and tetrone, 18: 25490(T) (AEC-tr-6372(p.197-205))

CHLORINE ISOTOPES Cl-37
proton reactions (p,n), resonances in, 18: 26672

CHOLESTEROL
effects of dietary, on development of atherosclerosis in irradiated pigeons, 18: 25087(R) (TID-20641)

CHOLINESTERASES
radiation effects on activity of, in blood serum in rats, 18: 25154

CHROMATE IONS
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374

CHROMATOGRAPHY
ionization detector design for gas, 18: 25770(P)
of desoxyribonucleic acid from rat spleen, 18: 25084 (NYO-2568-1)

CHROMIUM
alloying effects on niobium oxidation, 18: 25936
alloying effects on electric conductivity, hardness, and structure of niobium, 18: 25999
deposition on niobium–zirconium alloy by fused salt bath method, 18: 25896(R) (PF-63-3)
determination in steel by x-ray fluorescence, 18: 25275
determination in trace amounts in uranium and uranium compounds, 18: 25272 (VDDIT-90)
diffusion in gamma uranium, 18: 25969(R) (ANL-6868(p.287-302))
diffusion into liquid iron at 1923°K, 18: 26010
effects on stress corrosion of aluminum–copper–magnesium–zinc alloys, 18: 25946(T) (RSIC-177)
electronic structure of, analysis by neutron diffraction, 18: 25979(R) (ORNL-3582(p.7-8))
growth and properties of crystals of, 18: 26009
melting temperature of, equations for calculating, 18: 25990
neutron capture cross sections at 0 to 50 kev, 18: 26570

CHROMIUM ALLOYS
Cr–Cu–Fe–Mo–Ni–Ti, corrosion and fabrication properties for use as nuclear fuel reprocessing plant dissolver, 18: 25996
Cr–Fe–Ni, corrosion of Incoloy 800 by steam, 18: 26824(R) (ANL-6885)
Cr–Fe–Ni, electron-microprobe analysis for components, 18: 25269(R) (NLCO-905)
Cr–Mn, crystal structure of dilute, 18: 25979(R) (ORNL-3582(p.7-8))
Cr–Mo, phase diagrams, 18: 25998
Cr–Mo–Nb, properties and structure at high temperatures, 18: 26012
Cr–Mo–Nb–Ta, composition having superior high-temperature strength, 18: 25917(P)
Cr–Mo–Ta, composition having superior high-temperature strength, 18: 25917(P)
Cr–Nb, cellular precipitation of intermetallic compound $NbCr_2$ in, 18: 26022
Cr–Nb, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Cr–Pd, antiferromagnetism in, 18: 25978(R) (ORNL-3582(p.5-6))
Cr–Pd, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Cr–V, thermodynamic properties at 1550°K, 18: 25970(R) (ANL-6868 (p.303-25))

CHROMIUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

CHROMIUM ISOTOPES Cr-50
neutron capture cross sections at 0 to 50 kev, 18: 26570
proton inelastic scattering by, energy levels from, 18: 26619

CHROMIUM ISOTOPES Cr-51
neutron capture by, L/K ratio in, 18: 26665

CHROMIUM ISOTOPES Cr-52
neutron capture cross sections at 0 to 50 kev, 18: 26570

CHROMIUM ISOTOPES Cr-53
neutron capture cross sections at 0 to 50 kev, 18: 26570

CHROMIUM ISOTOPES Cr-54
production by proton reactions in thick iron targets, cross sections for, 18: 26583

CHROMIUM NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

CHROMIUM OXIDES
$CaO–Cr_2O_3–Fe_2O_3$, analysis by x-ray fluorescence, 18: 25275
$Cr_2O_3–NiO$, analysis by x-ray fluorescence, 18: 25275

CHROMIUM STEEL
Cr–Mo, corrosion by sodium at 500 to 600°C, 18: 25937
Cr–Mo, welding of thick, by electroslag techniques, 18: 25945(T,R) (EURAEC-1039)
Cr–Mo–V, creep of, enthalpy and entropy of activation of, 18: 25974 (EURAEC-1037)
Cr–Ni–Ti–W, analysis of carbide phase isolated from, activation, 18: 25289

CHROMIUM SYSTEMS
Cr–Fe–UC, phase studies, 18: 26058

CHROMOSOMES
aberrations in bone marrow, in irradiated mice given transplants of irradiated bone marrow cells, 18: 25201
properties of x-radioinduced monosomes in Cherokee oat, 18: 25207
radiation effects on lymphocyte, following radiotherapy of ankylosing spondylitis, x, 18: 25158
radiation effects on leukocyte, in man, 18: 25163
radioinduced aberrations in salivary gland, of *Chironomus tentans* larvae, 18: 25212
radioinduced aberrations in, of onion seeds, 18: 25179

radioinduced and chemically induced aberrations in, of barley, 18: 25182
CIRCUITS
design for selective operation of stepping motors, 18: 25654(P)
design for semiconductor detectors for particle identification, 18: 25794 (NAS-NRC-Pub-1184(p.96-103))
design of ferroelectric hysteresis bridge, 18: 25738 (BNL-8006)
design of tunnel-diode discriminator, 18: 25774(P)
development of nanoboxes for spark-chamber triggering, 18: 25827 (NAS-NRC-Pub-1184(p.325-30))
use of transistorized analog, in pulse-height arithmetic, 18: 25800 (NAS-NRC-Pub-1184(p.136-9))
CIVILIAN DEFENSE
sanitation measures for, 18: 25720
training in, for veterinarians, 18: 25732
CLAYS
carbon-13/carbon-12 and oxygen-18/oxygen-16 ratios in calcium carbonates from Pleistocene varved, from Toronto, Canada, 18: 25695
CLEANING
methods for sample valves in mass spectrometers, 18: 25269(R) (NLCO-905)
CLOUD-ION CHAMBERS
care and maintenance of, 18: 25862
CLOUDS
radioactivity, 18: 25692
COAL
analysis for ash content by irradiation and counting, 18: 25311(P)
analysis for sulfur by combustion, 18: 25302
COATINGS
development for oxidation protection of niobium alloys, 18: 25896(R) (PF-63-3)
COAXIAL CABLES
electric insulation for, screening and transmission properties of mineral, at .01 to 100 Mc at 400°C, 18: 26830 (AEEW-M-369)
use of superconducting, for storage in memory devices, 18: 26490
COBALT
content in reactor steels, acceptable limits of, 18: 26034
determination in trace amounts in uranium and uranium compounds, 18: 25272 (VDDIT-90)
diffusion in gamma uranium, 18: 25969(R) (ANL-6868(p.287-302))
impregnation of carbon by liquid, 18: 25957(P)
ion exchange behavior in organic solvents containing organic acids, 18: 25305
melting temperature of, equations for calculating, 18: 25990
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
solvent partition in aqueous bromide–TBP systems, 18: 25382
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
COBALT ALLOYS
Co–Nb–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Co–Nb–Ta, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Co–Pd, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Co–Ta–Ti, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Co–Ta–Zr, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
COBALT CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
COBALT COMPLEXES
with dialkyl phosphoric acids, preparation and properties, 18: 25429
with substituted 2-(pyridyl) and 2-(quinolyl)-1,3-indanediones, acid dissociation and formation constants of, 18: 25457
COBALT ISOTOPES Co-60
content in Sputnik 4 fragment, 18: 26127
production by proton reactions in thick iron targets, cross sections for, 18: 26583
uptake by biological organisms in fresh-water pond, 18: 25079
COBALT NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
COBALT OXIDES
preparation and properties of monocrystalline, 18: 25893(R) (ANL-6868 (p.355-72))
reactions with oxides of europium and dysprosium, 18: 26896(R) (ANL-6868(p.133-74))
thermodynamics of nonsubstitutional solid solutions of, statistical model for, 18: 25421
CaO–CoO–V_2O_5–ZnO, analysis by x-ray fluorescence, 18: 25275
CoO–Fe_2O_3, analysis by x-ray fluorescence, 18: 25275
COBALT PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
COBALT SYSTEMS
Co–Dy_2O_3, radiation effects on compressive strength and cobalt-60 production, 18: 26897(R) (ANL-6868(p.175-87))
Co–WC, tensile properties, 18: 26004
COINCIDENCE CIRCUITS
design for linear amplifiers, 18: 25799 (NAS-NRC-Pub-1184(p.124-34))
discriminator circuits for, antiwalk, 18: 25795 (NAS-NRC-Pub-1184 (p.112-16))
COINCIDENCE COUNTERS
design of 4π, for mutual anticoincidence, 18: 25843
COLCHICINE
genetic effects in sorghum, 18: 25130
COLLIMATORS
design for body scanning in radiodiagnosis, 18: 25257
design for scanning head used in radiodiagnosis, 18: 25258(P)
COLLOIDS
distribution of phosphorus-32-labeled, in liver of rabbits, 18: 25075
properties of scintillating, for measurement of weak beta activities, 18: 25864
COMMUNICATION SYSTEMS
radiation effects on, protection against electromagnetic, 18: 26819
COMPRESSION
calculation of, 18: 25367
COMPUTER PROGRAMS
BOOMER, transient response of SNAP 2/10A reactor, 18: 26957 (NAA-SR-8414)
for calculating sensitivity and resolution of collimators for body scanning in radiodiagnosis, 18: 25257
for calculation of contents of elements in solar atmosphere, 18: 26202
for crystal lattice type and cell constants from x-ray powder diffraction data, for IBM 7074, 18: 26108 (IS-839)
for neutron and proton inelastic-scattering angular distributions and cross sections in Hauser-Feshbach theory, binary bode for CDC-1604, 18: 26556 (ORNL-TM-875)
GRAPE, classical many-body approach to radiation damage in crystals for IBM 7090/7094, 18: 26070 (BNL-7979)
LASSY-2, for stress analysis of filament-wound shell structures, 18: 26115 (SCL-TM-64-53)
NDF PRINT, for annotated listings of neutron cross section data in Nuclear Data Library, IBM-7030, 18: 25879 (AWRE-O-4/64)
SCATT, for multiple-scattering corrections to partial neutron cross sections, for IBM 7094, 18: 26530 (BNL-8028)
Steady Darcian Flow in Soils, for calculation of steady flow through porous media on IBM 7090, 18: 26975 (HW-72335(Pt.2))
TURTLE, two-dimensional axially symmetric multigroup stationary neutron transport equation solution for IBM 7030, 18: 26497 (AWRE-O-66/63)
COMPUTERS
applications in studies of radiation effects on life span of dogs, 18: 25094(R) (UCD-472-109(p.173-7))
description of PDP-5, 18: 25881 (NAS-NRC-Pub-1184(p.266-8))
description of SDS 9300, 18: 25882 (NAS-NRC-Pub-1184(p.269-70))
design of modular components for, compatibility in, 18: 25814 (NAS-NRC-Pub-1184(p.210-11))
design of stored program radiation analyzers, 18: 25821 (NAS-NRC-Pub-1184(p.255-65))
development of high-resolution time analyzer, 18: 25753
development of ultrahigh-speed analyzer-computer system, 18: 25818 (NAS-NRC-Pub-1184(p.229-36))
instrumentation for on-line operation of digital, in nuclear physics experiments, 18: 25888

model of one-dimensional plasma for studies of instabilities, 18: 26800
review of Chalk River facilities, 18: 25742 (NAS-NRC-Pub-1184(p.23-35))
system of multiple, design of, 18: 25885
use in analysis of cell multiplication in tissues, 18: 26982(R) (NYO-2462-1)
use in determining parameters for multi-hit and multi-target survival curves for x-irradiated animal and bacteria cells, 18: 25170
use of analog system in pulse-height analysis, 18: 25800 (NAS-NRC-Pub-1184(p.136-9))
use of Atlas on-line at Harwell, 18: 25880 (NAS-NRC-Pub-1184(p.247-54))
use on time-shared basis for real-time processing, 18: 25883 (NAS-NRC-Pub-1184(p.271-82))
use on-line with multiparameter pulse analyzer and linac, 18: 25820 (NAS-NRC-Pub-1184(p.239-46))
use on-line with spark chamber, 18: 25779 (CONF-182-15)
uses at ANL, review of, 18: 25744 (NAS-NRC-Pub-1184(p.38-9))
uses of Chebyshev polynomials in, 18: 26824(R) (ANL-6885)

CONCRETES
control and testing, gamma spectroscopic, 18: 25676
density determinations using radioisotopes, 18: 25699(T) (OTS-63-11008 (p.15-21))
gamma buildup factors for ferrophosphorus, 0.5- to 10-Mev, 18: 26814(T) (ORNL-tr-80)
gamma scattering by, albedo for 0.66-Mev, 18: 26817
neutron ages in, at 1.44 ev to 2.5 Mev, 18: 26515
use in pressure vessels, 18: 26946

CONFERENCES
Cryogenic Engineering, Boulder, Colorado, Aug. 1963, 18: 26460
Exponential and Critical Experiments, Vol. 1, Amsterdam, Sept. 2 to 6, 1963, 18: 26873
Exponential and Critical Experiments, Vol. II, IAEA, Amsterdam, Sept. 2 to 6, 1963, 18: 26881
Instrumentation Techniques in Nuclear Pulse Analysis, U.S.N. Post-graduate School, Monterey, Calif., April 20 to May 3, 1963, 18: 25781 (NAS-NRC-Pub-1184)
Magnetoplasmadynamic Electrical Power Generation, University of Durham, Sept. 6-8, 1962, 18: 26257
Materials, Advances in, Manchester College, England, April 1964, 18: 25907
Mechanics of Turbulence, Marseille, Aug. 28 to Sept. 2, 1961, 18: 26152
On Basic Mechanisms in The Radiation Chemistry of Aqueous Media, Proceedings of, Gatlinburg, Tennessee, May 8–10, 1963, 18: 25575
Plasma Physics and Controlled Nuclear Fusion Research, Salzburg, Sept. 1961, 18: 26694(T) (AEC-tr-5589)
Quantum Electronics, Berkeley, March 23/25, 1961, 18: 26435
Radiation and Skin, Symposium, Winfrith, Nov. 14, 1963, 18: 25037 (AHSB(RP)R-39)
Weak Interactions, Brookhaven, Sept. 1963, 18: 26260 (BNL-837)

CONNECTIVE TISSUE
pathological effects of injected Thorotrast in, 18: 25065

CONNECTORS (ELECTRIC)
grounding structure for use during coupling of, 18: 26996(P)

CONTAMINATION
of skin by radioactive substances, mechanism of permeation, 18: 25056 (AHSB(RP)R-39(p.79-86))

CONVECTION (FORCED)
transient, from flat plate subjected to step energy input, 18: 25666

COPPER
alloying effects on oxidation of plutonium–uranium alloys, 18: 26893(R) (ANL-6868(p.11-108))
determination in gallium and gallium compounds by neutron activation, 18: 25300
determination in hydrochloric and nitric acids, activation, 18: 25286
diffusion in gamma uranium, 18: 25969(R) (ANL-6868(p.287-302))
diffusion of palladium in, 18: 25969(R) (ANL-6868(p.287-302))
effects on plant assimilation of ammonia and nitrate nitrogen, tracer studies of, 18: 25059(T) (OTS-63-11008(p.6-14))
electron backscattering at 8 to 22 Mev, 18: 26216
electron beam energy losses at 4 to 15 kev, 18: 26822(T)
electron reactions at 20 to 50 kev, $K\alpha$ intensities from, 18: 26205
exploding wire phenomena in, plasma production in underwater, 18: 26754
fabrication of tubular, 18: 25939(R) (ANL-6868(p.201-18))
gamma scattering at 662 kev, Rayleigh, 18: 26292
gas release and swelling in, model for, 18: 26080
helium-3 elastic scattering at 20 Mev, differential cross sections, 18: 26681
inspection of brazes of, using heat-pulse method, 18: 26824(R) (ANL-6885)
ion exchange behavior in organic solvents containing organic acids, 18: 25305
melting point of, correlation with energy of motion of monovacancies, 18: 26037
melting temperature of, equations for calculating, 18: 25990
mixing with nickel in fluidized-packed beds, particulate movement in, 18: 25658
neutron scattering cross sections at 0.5 to 0.8 Mev, 18: 26571
photon reactions at 150 to 720 Mev, 18: 26589
protective effects against nucleic acid decomposition by nuclease, 18: 25085 (SGAE-BL-5/1964)
radiation effects on crystalline, 18: 26069(R) (ANL-6868(p.373-417))
radiation effects on strength of single crystal, fast neutron, 18: 26074
solvent partition in aqueous bromide–TBP systems, 18: 25382
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
thermal properties, 18: 26896(R) (ANL-6868(p.133-74))

COPPER ALLOYS
Al–Cu, radiation effects on structure of crystalline, 18: 26069(R) (ANL-6868(p.373-417))
Al–Cu, radiation effects on strength of single crystal, 18: 26074
Al–Cu–Mg–Zn, corrosion resistance of, effects of age hardening, chromium, and silver on stress, 18: 25946(T) (RSIC-177)
Cr–Cu–Fe–Mo–Ni–Ti, corrosion and fabrication properties for use as nuclear fuel reprocessing plant dissolver, 18: 25996
Cu–Au, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))
Cu–Fe–Zr, corrosion by steam, effects of additives on, 18: 26824(R) (ANL-6885)

COPPER BROMIDES
use in plating of uranium with magnesium, 18: 25911(P)

COPPER CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

COPPER COMPLEXES
with dialkyl phosphoric acids, preparation and properties, 18: 25429
with substituted 2-(pyridyl) and 2-(quinolyl)-1,3-indanediones, acid dissociation and formation constants of, 18: 25457

COPPER ISOTOPES Cu-61
production in proton reactions with silver at 2.9 Bev, range studies of, 18: 26648

COPPER ISOTOPES Cu-64
production in proton reactions with silver at 2.9 Bev, range studies of, 18: 26648
use in radiodiagnosis, 18: 25257

COPPER NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

COPPER PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

CORROSION
in fast neutron breeder, gas cooled graphite, and pressurized water reactors, 18: 25924

COSMIC ALPHA PARTICLES
effects on ionospheric radio wave absorption near poles, 18: 26445

COSMIC ELECTRONS
spectra of low-energy, in disturbed ionospheric E-region, 18: 26455

COSMIC MESONS (μ)
ionization energy loss in plastic scintillator, 18: 25842

COSMIC NEUTRONS
distributions in atmosphere from solar proton reactions, 18: 26446

COSMIC PROTONS
reactions in atmosphere, neutron flux from, 18: 26446

recurrence of solar, 18: 26243
shielding against solar-flare, 18: 26815
COSMIC RADIATION
contribution to gamma activity of air, 18: 25694
review, 18: 26245
shielding space vehicles against, problems in, 18: 26816
uses for meteorite age estimation, 18: 26189
COTTON
radioinduced graft polymerization on styrene, solvent effects on, 18: 25474(T) (AEC-tr-6372(p.83-8))
radioinduced graft polymerization on styrene, effects of chemical treatment, pretreatment, and refining on reactivity of, 18: 25475(T) (AEC-tr-6372(p.89-96))
COUNTING DEVICES
design of reversible decimal, 18: 25755
CREEP
mechanisms of, mathematical procedure for determining proportions of partial, 18: 25974 (EURAEC-1037)
***p*-CRESOL**
thermal and radioinduced polymerization of, products of, 18: 25496(T) (AEC-tr-6372(p.261-72))
CRITICAL ASSEMBLIES
analysis of Rapsodie configuration in ZPR-III, 18: 26824(R) (ANL-6885)
conference on exponential and critical experiments, 18: 26873
conference on exponential and critical experiments, 18: 26881
description and operation of French fast-neutron MASURCA, 18: 26875
description of KRITO, for zero-power light-water-moderated experiments with low-enrichment fuel, 18: 26883
design and operation of French VERA, 18: 26876
exponential experiments using natural uranium, 18: 26880
fuel plate fabrication for ZPR-VI, 18: 25939(R) (ANL-6868(p.201-18))
fuels for zero-power, development of, 18: 26824(R) (ANL-6885)
lattice parameters for heavy-water 2% enriched uranium, 18: 26886
neutron active zones in, study using active and passive surface methods, 18: 26879
neutron reactions in beryllium–uranium, 18: 26248
neutron spectra in French ALECTO, 18: 26885
operations of ZPR-IX, 18: 26824(R) (ANL-6885)
reactivity of NORA, void effects on, 18: 26884
reactivity parameters of High Conversion Critical Experiment, 18: 26824(R) (ANL-6885)
reactivity parameters of ZPR-III and -VII, 18: 26824(R) (ANL-6885)
review of program of French AEC on, 18: 26874
safety analysis of Plutonium Recycle Experiment, 18: 26824(R) (ANL-6885)
void reactivity experiments in Norwegian NORA, 18: 26947
CRITICALITY STUDIES
of uranium dioxide–heavy water lattices for CVTR, 18: 26863 (CVNA-134)
CROSS SECTIONS
electromagnetic, for electron and nuclear research, 18: 26684
CRUSTACEA
radiation effects on gill formation and regeneration in *Branchiura sowerbyi*, 18: 25135
CRYOGENICS
conference, 18: 26460
superheat in liquid nucleate boiling, metastable, 18: 26461
CRYOSTATS
design of helium-3, 18: 26473
CRYSTAL STRUCTURE
computer program for lattice type and cell constants from x-ray powder diffraction data, 18: 26108 (IS-839)
interactions in, Green's function for exciton-phonon, 18: 26424
Kronig-Penney, electronic states in, 18: 26222
quantum relaxation and lattice absorption and inelastic neutron scattering line shapes in, 18: 26130
CRYSTALS
gamma scattering by, interference of Rayleigh and nuclear-resonant, 18: 26656
gamma scattering by, electronic and nuclear-resonant, 18: 26658
neutron incoherent scattering by, phonon spectra from, 18: 26520(T)
neutron scattering by, 18: 26509
point defect clustering in irradiated and quenched, effects of annealing on, 18: 26069(R) (ANL-6868(p.373-417))
preferred orientation of, detection of, 18: 25269(R) (NLCO-905)
radiation damage in, computer program for many-body solutions for, 18: 26070 (BNL-7979)
CUPFERRON
analytical use in determination of zirconium, 18: 25277
analytical use in determination of plutonium in urine, 18: 25299
CURIUM ISOTOPES Cm-244
neutron strength functions, 18: 26650
neutron total cross sections at 0.01 to 900 ev, 18: 26650
CURIUM ISOTOPES Cm-246
neutron strength functions, 18: 26650
CUTTING TOOLS
design for desheathing reactor fuel rods, 18: 25651(P)
CYCLOHEXANE
effects on yields in radiolysis of *o*- and *p*-toluenethiol, 18: 25549
radiation effects on, ESR spectra of, 18: 25520(T) (AEC-tr-6372(p.481-90))
benzene–cyclohexane, energy transfer in radiolysis of, 18: 25544
benzene–cyclohexane, luminescence quenching by carbon tetrachloride in, 18: 25563
benzene–cyclohexane, radiolysis of, hydrogen isotopic yields in gamma, 18: 25566
benzene–cyclohexane, radiolysis of deuterated, hydrogen isotopic yields in gamma, 18: 25566
cyclohexane–S–toluene, radiolysis of, formation of sulfur compounds in, 18: 25547
CYCLOHEXANE, PHENYL-
radiation effects on, ESR spectra of, 18: 25520(T) (AEC-tr-6372(p.481-90))
CYCLOHEXENE
radiation effects on, ESR spectra of uv effects on, 18: 25523(T) (AEC-tr-6372(p.495-8))
acetaldehyde–cyclohexene, radioinduced telomerization of, 18: 25510(T) (AEC-tr-6372(p.405-12))
CYCLOPENTADIENE
radiation effects on, ESR spectra of free radicals produced in, 18: 25522(T) (AEC-tr-6372(p.493-4))
CYCLOTRON RADIATION
emission from plasma, collective effects in, 18: 26803
emission of v-l-f, from outer atmosphere, 18: 26439
spectral line broadening by impurities in germanium at 11°K, 18: 26112 (NP-14017)
CYCLOTRONS
design development for AEG relativistic isochronous, 18: 26174
CYLINDERS
neutron transport in, discrete-ordinates method for, 18: 26512
thermal stress analysis of anisotropic hollow graphite, 18: 26116 (WADD-TR-61-72(Vol.XIX))
CYSTEINE
effects on genetic recombination in Sordaria, 18: 25222
radiation effects on ESR spectra of, dose rate effects on, 18: 25539
CYSTINE
dihydrochloride, radiation effects on ESR in, 18: 25565
radiation effects on ESR spectra of, dose rate effects on, 18: 25539
CYTOLOGY
cell growth, computer analysis of, 18: 26982(R) (NYO-2462-1)
of thorium dioxide deposits in human bone marrow, 18: 25076

D

DATA RECORDING SYSTEMS
design of tape unit for pulse-height data, 18: 25889
development for Hanford Production Reactors for engineering and research, 18: 26955 (HW-81088)
DATA TABULATIONS
fission-product element yields and characteristics, 18: 25322 (GAMD-891(Rev.1))
functions for Mott scattering of electrons by gold and mercury, 18: 26236
geomagnetic and sunspot data for 1963 and 1964, 18: 26453

neutron cross sections, NCSAG requests for, 18: 26559 (WASH-1047)
on helium and hydrogen hyperfragment decays, 18: 26622
x-ray fluorescence tables for ethylenediamine dextrotartrate, 18: 25449 (Y-1470-D)
DECONTAMINATING SOLUTIONS
effectiveness of, for skin, 18: 25213 (AHSB(RP)R-39(p.69-77))
DECONTAMINATION
methods of, for radioactive surfaces, 18: 25724
methods of, for skin, 18: 25233
mobile unit for, of water, 18: 25726(T)
of skin, 18: 25213 (AHSB(RP)R-39(p.69-77))
DEER
radioactivity of Arctic, effects of fallout fission products on, 18: 25055 (NP-13985)
DELAY LINES
use of superconducting, for storage in memory devices, 18: 26490
DENSITOMETERS
design of radiometric, for detecting defective areas in nonmetallic materials, 18: 25773(P)
DENSITY
apparatus for measurement of, of soil, 18: 25775(P)
DEUTERIUM
abstraction by trifluoromethyl radicals, kinetics of, 18: 25261
binding to oxygen in water-d_2, length of, 18: 25417(T)
diffusion in latex and neoprene, 18: 25315 (AWRE-O-56/57)
diffusion through neoprene and polyvinyl chloride, 18: 25705 (AWRE-O-17/62)
exchange with hydrogen in monohydrofluorocarbons in methanol–sodium methoxide system, formation of perfluorocarbanions in, 18: 25451
exchange with hydrogen in resorcinols and related compounds in alkaline solution, 18: 25453
heat capacity of liquid and solid, 18: 25365
helium-3 reactions (^{3}He,p) at 32 Mev, helium-4 energy levels from, 18: 26528 (BNL-7983)
isotopic analysis of, design of thermostat for densimetric, 18: 25750 (PAN-459/XVI)
proton reactions (p,n), resonances in, 18: 26672
reactions of hot atoms of, in photolyzed hydrobromic acid–gas mixtures, 18: 25597
reactions with hot hydrogen atoms, 18: 25597
separation of para-, from ortho-hydrogen by sorption on gamma-alumina at 20.4°K, 18: 25442
spin conversion of para-, with ortho-hydrogen on alumina catalysts, 18: 25442
DEUTERONS
electrochemical discharge of, quantum energy distribution and tunnel effects in, 18: 26209
emission in proton reactions (p,pd) with nuclei, wave functions for, 18: 26643
fission of plutonium-237 at 21 Mev, cross sections for formation of cesium-134 isomeric pair in, 18: 26585
interactions with photons, meson ($\pi^\pm$) production in, 18: 26317
interactions with mesons (K^-) at 1.49 Bev/c, Y_1^* resonances in, 18: 26328
interactions with antiprotons at 2.8 Bev/c, hyperons (Λ), (Σ^-), and ($\bar{\Xi}^+$) production in, 18: 26334
nucleon potentials in, 18: 26285
photodisintegration, dispersion theory of pion exchange currents in, 18: 26375
reactions (d,α) with aluminum-27 at 4.50 to 5.62 Mev, 18: 26634
reactions (d,αn), (d,n), (d,2n), and (d,2p) with titanium-47 at 4 to 20 Mev, excitation functions for, 18: 26649
reactions (d,α) with beryllium-9, nitrogen-14, fluorine-19, and phosphorus-31, theoretical and experimental angular distributions, 18: 26675
reactions (d,p) with sodium-23 at 1.51 Mev, angular distributions and excited levels in, 18: 26659
reactions (d,p), DWBA and stripping matrix element with finite-range, 18: 26626
reactions (d,t) with helium-3 at 27 Mev, diproton existence from, 18: 26533 (NP-13974)
reactions (d,2n) with lithium-7, distributions from, 18: 26548(R) (ORNL-3582(p.99))
reactions of photochemically produced, in ethane, hydrogen, and methane, 18: 25561
reactions with bismuth, astatine isotope production in, 18: 26602
reactions with fluorine-19 at 500 to 700 kev, coincidence measurements for, 18: 26574
reactions with lead, astatine isotope production in, 18: 26602
reactions with lithium-6, 25-Mev beryllium-8 level from, 18: 26617
scattering by carbon and mercury impurities in vanadium targets, cross sections for, 18: 26560
scattering by nuclei at 10 Mev, elastic, 18: 26561
wave functions for ground-state, 18: 26284
wave functions for, 18: 26306
wave functions of, analytic, 18: 26308
DIDODECYLAMINE, *N*-BENZYL-
solvent properties for uranium, 18: 25621
DIDODECYLAMINE, *N*-CYCLOHEXYL-
solvent properties for uranium, 18: 25621
DIELECTRICS
ferroelectric properties of, hysteresis bridge for measurement of, 18: 25738 (BNL-8006)
nuclear-spin polarization time of, electron-resonance excitation in, 18: 26652
DIET
cesium-137 content of, of people in southern Finland, 1961 to 1964, 18: 25687 (NP-13981)
effects of fatty and fat-free, on linoleic acid metabolism in liver fat of chicks, 18: 25077
radioactivity of Arctic, effects of fallout fission products on, 18: 25055 (NP-13985)
DIETHYLAMINE
radioinduced crosslinking reactions with epoxy resin, hardening in, 18: 25528(T) (AEC-tr-6372(p.539-46))
DIFFERENTIAL EQUATIONS
Appell function F_3 in partial, 18: 25884
DIHEXYLAMINE, *N*-BENZYL-2,2'-DIETHYL-
solvent properties for uranium, 18: 25621
DIHEXYLAMINE, *N*-CYCLOHEXYL-2,2'-DIETHYL-
solvent properties for uranium, 18: 25621
DIKETONES
complexes with europium, spectra and quantum states of, in polymethylmethacrylate, 18: 25462
DIODES
thermoelectric properties of plasma, theory of, 18: 26250 (AD-423086)
use of avalanche, in random-pulse generator, 18: 25815 (NAS-NRC-Pub-1184(p.212-15))
DIOXANE
effects on ion exchange of uranium and other elements in system with organic acids, 18: 25305
effects on radioinduced graft polymerization of celluloses on styrene, 18: 25474(T) (AEC-tr-6372(p.83-8))
effects on yields in radiolysis of α- and p-toluenethiol, 18: 25549
radioinduced thermoluminescence in, decay and dose effects on, 18: 25473(T) (AEC-tr-6372(p.75-82))
DISEASES
cancer, frequency of occupational, 18: 25211
drug-induced, review, 18: 25046
radioinduced, review, 18: 25046
radiotherapy of Hodgkin's disease, time-dose relations for, 18: 25251
DISSOLVERS
design for uranium fuel elements, 18: 26903
material selection for nuclear fuel reprocessing plant, 18: 25996
DODECYLAMINE, *N*-BENZYL-
solvent properties for uranium, 18: 25621
DODECYLAMINE, *N*-CYCLOHEXYL-
solvent properties for uranium, 18: 25621
DOGS
aging effects in beagles, 18: 25089(R) (UCD-472-109(p.18-44))
effects of Thorotrast on bilirubin content in lymph and serum in, 18: 25060
pathology of irradiated aged, 18: 25093(R) (UCD-472-109(p.62-172))
psychological field studies on irradiated aging, 18: 25091(R) (UCD-472-109(p.49-52))

radiation effects on life-span of beagles, 18: 25089(R) (UCD-472-109 (p.18-44))
radiation effects on eyes of, 18: 25090(R) (UCD-472-109(p.45-8))
radiation effects on reproductive capacity of female, 18: 25092(R) (UCD-472-109(p.53-61))
radiation effects on life-span of, statistical analysis of, 18: 25094(R) (UCD-472-109(p.173-7))
radiation sickness effects on ascorbic acid content in brain tissue of, 18: 25161
regional blood flow through skin of, krypton-85 measurement of, 18: 25070

DROSOPHILA
radioinduced mutations in, by exposure of males, 18: 25108
radiosensitivity of embryos of, 18: 25143

DRUGS
sensitivity of leukemias to, use in classification, 18: 25049

DRY BOXES
diffusion of deuterium, hydrogen, and tritium through gloves in, 18: 25706 (AWRE-O-17/62)
diffusion of gases through latex and neoprene gloves in, 18: 25315 (AWRE-O-56/57)
diffusion of gases through synthetic rubber gloves in, 18: 25467 (AWRE-O-54/57)

DYSPROSIUM
determination using Xylenol Orange, spectrophotometric, 18: 25285
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
magnetic moment of ions of, in crystalline state and in solution, 18: 25350
polarography in aqueous lithium chloride solutions, 18: 25333
reactions in calcium fluoride, photochemical and thermal, 18: 25599
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
sorption by ion exchange resins from nitric acid–2-propanol–water solutions, 18: 25395
Young's modulus, 18: 26006

DYSPROSIUM ALLOYS
Al–Dy, structure of Dy_2Al_3, 18: 25989
Al–Dy, structure of $DyAl_2$, 18: 25989
Dy–Ge, structure of Dy_5Ge_3, 18: 25989
Dy–Ho, magnetic transition temperatures in, 18: 25980(R) (ORNL-3582 (p.9-10))
Dy–Tb, magnetic transition temperatures in, 18: 25980(R) (ORNL-3582 (p.9-10))
Dy–Y, magnetic properties of, 18: 25981(R) (ORNL-3582(p.11-16))

DYSPROSIUM AZIDES
thermal decomposition of, differential thermal analysis of, 18: 25446

DYSPROSIUM ISOTOPES Dy-150
alpha decay, 18: 26615
alpha decay of, energies and rates for, 18: 26640

DYSPROSIUM ISOTOPE S Dy-151
alpha decay, 18: 26615

DYSPROSIUM ISOTOPES Dy-152
alpha decay, 18: 26615

DYSPROSIUM ISOTOPES Dy-153
alpha decay, 18: 26615

DYSPROSIUM ISOTOPES Dy-155
decay spectra of, 18: 26566
production by proton reactions on dysprosium isotopes, cross sections, 18: 26584

DYSPROSIUM ISOTOPES Dy-157
production by proton reactions on dysprosium at 18 Mev, cross sections for, 18: 26584
production by proton reactions (p,p3n) and (p,p4n) on dysprosium isotopes at 38 Mev, cross sections for, 18: 26584

DYSPROSIUM ISOTOPES Dy-161
proton reactions (p,n) and (p,2n) at 9 to 87 Mev, cross sections for, 18: 26584

DYSPROSIUM ISOTOPES Dy-162
proton reactions (p,n), (p,2n), and (p,3n) at 9 to 87 Mev, cross sections for, 18: 26584

DYSPROSIUM ISOTOPES Dy-163
proton reactions (p,2n), (p,3n), and (p,4n) at 9 to 87 Mev, cross sections for, 18: 26584

DYSPROSIUM ISOTOPES Dy-164
proton reactions (p,3n) at 9 to 87 Mev, cross sections for, 18: 26584

DYSPROSIUM NIOBATES
$CaMoO_4$–$DyNbO_4$, fluorescence spectra, 18: 26017
$CaMoO_4$–$DyNbO_4$, preparation and spectra of, 18: 26017
$CaWO_4$–$DyNbO_4$, preparation, luminescent properties, and structure of, 18: 26017

DYSPROSIUM OXIDES
reactions with oxides of cobalt, iron, nickel, and uranium, 18: 26896(R) (ANL-6868(p.133-74))
Co–Dy_2O_3, radiation effects on compressive strength and cobalt-60 production, 18: 26897(R) (ANL-6868(p.175-87))
Dy_2O_3–UO_2, corrosion by steam at 650°C and water at 360°C, 18: 25919(R) (ANL-6868(p.190-200))

DYSPROSIUM SULFATES
reduction of anhydrous, by carbon monoxide, 18: 25427

DYSPROSIUM SYSTEMS
B–C–Dy, phase studies, 18: 25319 (COO-1140-103)

DYSPROSIUM TANTALATES
fluorescence spectra, 18: 26017

E

EARTH
magnetic field of, use of nuclear-resonance filter for measuring, 18: 26458

ECOLOGY
dispersion of radiation-sterilized male mosquitoes in natural populations, 18: 25047

EGYPT
radium and thorium contents of underground waters in, 18: 25696

ELASTOMERS
diffusion of deuterium, hydrogen, and tritium through neoprene, 18: 25706 (AWRE-O-17/62)
radiation effects on permeability, 18: 25467 (AWRE-O-54/57)

ELECTRIC ARC FURNACES
operation, 18: 25939(R) (ANL-6868(p.201-18))

ELECTRIC ARCS
hot-gas containment limits in coaxial flow discharge tubes, 18: 26687 (ARL-64-49)
production of high-intensity plasma radiation by, 18: 26811(P)

ELECTRIC CHARGES
electron scattering by point, wave functions for, 18: 26279
positron scattering by point, wave functions for, 18: 26279

ELECTRIC CONDENSERS
design with internal gas barrier, 18: 27000(P)

ELECTRIC CURRENTS
induction in anisotropic ionosphere, 18: 26442
interactions with conducting spheres, 18: 26770
measurement of large d-c, transformer system for, 18: 26997(P)

ELECTRIC DISCHARGE
charged particle motion in, equation for nonrelativistic, 18: 26147
electron emission from solids in, 18: 26164
electron time temperature in toroidal, 18: 26792
ionic-sound excitation in positive-column, 18: 26703(T) (AEC-tr-5589 (p.678-88))
ionization phenomena of hydrogen in pulsed, role of dissociation in, 18: 26716
materials development for, 18: 26806
microwave emission at electron cyclotron harmonics from positive column, 18: 26691 (IPPJ-23)
particle distributions in positive column, 18: 26720
regimes of predischarges under very low pressures, 18: 26715
theory of, fluid, 18: 26416
turbulent, in longitudinal magnetic fields, 18: 26696(T) (AEC-tr-5589 (p.438-62))
use in metal working, 18: 25955

ELECTRIC FIELDS
distribution in plasma waveguides, 18: 26778
plasma flow in magnetic and, stress tensor for, 18: 26734
plasma interactions with h-f, 18: 26775

plasma interactions with inhomogeneous, 18: 26776
wave equations in, Dirac, 18: 26403
ELECTRIC GENERATORS
design of high-voltage d-c, 18: 25650(P)
development and testing of thermoelectric, 18: 26251(R) (AD-437280)
superconducting direct-current, 18: 26465
ELECTRIC INSULATORS
properties for cables for reactor control pulse counting channels, 18: 26830 (AEEW-M-369)
radiation effects on, review on, 18: 26077
ELECTRIC POTENTIAL
Jost-function analyticity for coulomb, in complex angular momentum plane, 18: 26311
ELECTRIC POWER
generation in large nuclear stations, economics of, 18: 26993
production by thermionic conversion in power reactors, 18: 26933
ELECTRIC PROPERTIES
book: *High-Temperature Materials*. No. 2, *Properties Index*, 18: 26064(T)
ELECTRICITY
production from ionizing energy of reactor fission products, 18: 26254
ELECTROCHEMICAL ANALYSIS
electrode development for, 18: 25320 (COO-1148-84)
ELECTROCHROMATOGRAPHY
of desoxyribonucleic acid from rat spleen, 18: 25084 (NYO-2568-1)
ELECTRODES
adsorption measurements by ion-exchange membrane, 18: 25327 (RT/GEO(64)-1)
development for in-pile thermionic cells, 18: 26259
development of gauze, for electron optics, 18: 26129
electric potentials of radioactive, 18: 25553
ELECTRODYNAMICS
equations for ring current interactions with conducting sphere, 18: 26770
flow of conducting fluid over electric conductors, 18: 26774
multipole expansion in, 18: 26392
ELECTROLYTIC CELLS
graphite electrode development for, 18: 25320 (COO-1148-84)
thermodynamic properties of iron oxide– and nickel oxide–plutonium oxide, 18: 25893(R) (ANL-6868(p.355-72))
ELECTROMAGNETIC FIELDS
molecule interactions with resonant cavity mode of, quantum electrodynamic of, 18: 26399
plasma acceleration by gradients of, 18: 26742
production in accelerator cavities by charged particle beams, calculation of, 18: 26181
structure in plasma layer of zero permeability, 18: 26726
use in metal working, 18: 25955
ELECTROMAGNETIC LENSES
calculation of two-quadrupole, 18: 26178
ELECTROMAGNETIC SEPARATION
review of Harwell separators, 18: 25740 (EANDC(UK)-25L)
ELECTROMAGNETIC WAVES
development to nondestructive testing, 18: 25675(R) (ANL-6868(p.219-28))
emission by dipoles and point charges moving in gyrotropic medium, 18: 26396
excitation in plasma by ion beams, 18: 26722
interactions in plasma, 18: 26723
interactions with ionizing shock waves in d-c magnetic fields, 18: 26125
interactions with atomic systems, perturbation theory in, 18: 26423
plasma confinement by field of traveling, 18: 26709(T) (AEC-tr-5589 (p.869-87))
propagation across plasma cylinder in window problem, 18: 26690 (DI-82-0217)
propagation from nuclear explosions, shielding against, 18: 26819
propagation from plasma into vacuum, criteria for, 18: 26755
propagation in plasma, 18: 26699(T) (AEC-tr-5589(p.596-611))
propagation in plasma layers, 18: 26725
propagation in plasma wave guide in strong magnetic field, nonlinear, 18: 26784
propagation in plasma transverse to magnetic field, 18: 26785
propagation of longitudinal, in weakly dispersive media, 18: 26727
propagation of transverse, plasma magnetic-field, 18: 26713
reactions with plasma, absorption and dispersion in, 18: 26731
scattering from driven plasma oscillations, incoherent, 18: 26756
shielding communication systems against pulsed, 18: 26819
stabilities in nonstationary equilibrium media, 18: 26724
ELECTRON BEAMS
diagnostic use for plasma oscillations, 18: 26777
energy losses in metal films at 4 to 15 kev, 18: 26822(T)
interactions with plasma, instability in, 18: 26706(T) (AEC-tr-5589 (p.767-72))
transmission through aluminum films at 0.5 to 12 kev, energy spectra of, 18: 26821(T)
use in fabricating thin-film superconductors, 18: 26496(P)
use in working of materials, vacuum chamber for large workpieces, 18: 25964(P)
ELECTRON LENSES
electrodes for, development of gauze, 18: 26129
ELECTRON MICROSCOPES
feasibility of, with 1-Å resolution, 18: 25749(R) (ORNL-3582(p.40-1))
image current density measurement in, device for, 18: 25771(P)
ELECTRON MULTIPLIER TUBES
design for high-speed counting using planar dynode, 18: 25739 (CONF-182-16)
ELECTRON PAIRS
production of, cross section for, 18: 26564
ELECTRON TUBES
cathode heating using polonium-210, 18: 25870 (MLM-1154)
ELECTRONIC EQUIPMENT
design for radiation detectors, 18: 25850
design for use in nuclear measurements, 18: 25835
development for control and protection system of BR-1, 18: 26964
noise measurements on, correction factors for, 18: 25760
uses in radiation detection instrumentation, 18: 25832
ELECTRONICS
book: *Advances in Quantum Electronics*, 18: 26435
ELECTRONS
absorption by aluminum, effects of excitation, ionization, and Coulomb scattering on, 18: 26823
backscattering by nuclei, formulas for equivalent atomic number of complex targets for saturation in, 18: 26660
binding in aqueous solutions, model for, 18: 25577
biological effects of fast, on infectious nucleic acid portion and whole tobacco mosaic virus, 18: 25159
capture by multiply charged ions, cross sections for, 18: 26229
capture by protons, cross sections for, 18: 26227
capture by protons, cross sections for, 18: 26228
chemical effects on methane–oxygen mixtures, 18: 25465 (AERE-R-4581)
cyclotron radiation from atmospheric, v-l-f, 18: 26439
density profiles in ionospheric D layer, rocket probe for determining, 18: 26452
distribution in outer radiation zone and magnetosphere boundary, Explorer XII observations on, 18: 26246
distributions in positive column discharge, 18: 26720
effects on deformation of zinc single crystals, 18: 26090
effects on excitability of frog heart, 18: 25098
effects on field-effect and injection transistors at 1 Mev, 18: 25741 (N64-13153)
effects on impurity-doped silicon crystals, energy levels of defects induced in, 18: 26089(T)
electromagnetic field from, moving in gyrotropic medium, 18: 26396
emission by solid carbon dioxide and xenon, secondary, 18: 26156
emission from solids in gas discharges, 18: 26164
excitation of 2s and 2p energy levels in hydrogen by, cross sections for, 18: 26203 (NASA-TN-D-2145)
formation and detection of hydrated, in radiolysis of water, 18: 25576
hydration energy and redox potential of hydrated, thermodynamic functions of, 18: 25581
inertia of, magnetohydrodynamic effects of, 18: 26149
injection into ion beams, neutralization by, 18: 26148
intensity variations in outer radiation belt, 18: 26444
interactions in many-body systems of, quantum kinetic equations for, 18: 26405
interactions with phonons, thermodynamic potential of, 18: 26143
interactions with protons, meson (π) production in, 18: 26312

interactions with nucleons, theory of, 18: 26667
kinetic theory of gases of, 18: 26748
mass of, general relativity in static, spherically symmetric models for, 18: 26357
mobilities in cesium vapor by pulsed-discharge technique, 18: 26103 (AROD-3588:2)
oscillations in two-temperature Maxwellian plasma, linearized transport treatment of, 18: 26801
partition function for bound, in magnetic field, 18: 26393
position operator for Dirac, 18: 26363
position operator for Dirac, 18: 26364
radiation emission in plasma, gyroresonance, 18: 26721
radiation emission from cylindrical bunches of, in heterogeneous medium, 18: 26788
radiation length of 800-Mev, in nuclear emulsion, 18: 26295
reactions of hydrated, in irradiated aqueous solutions of single-carbon compounds, 18: 25579
reactions with chemisorbed oxygen at 0 to 300 ev, 18: 26206
reactions with copper at 20 to 50 kev, Kα intensities from, 18: 26205
reactions with silver foils transition radiation from, 18: 26224
relaxation path of elastically scattered, Born approximation for calculating, 18: 26371
scattering at 8 to 22 Mev, back-, 18: 26216
scattering by atomic hydrogen, excitation of $2p$ state in, 18: 26225
scattering by butane, dissociation and ionization from, 18: 26204
scattering by gold and mercury, Mott, 18: 26236
scattering by impurity atoms in solids, theory of, 18: 26212
scattering by nuclei, cross section for, 18: 26564
scattering by oxygen-16, energy-level excitation in inelastic, 18: 26609
scattering by point charges, wave functions for, 18: 26279
spin operators for orbital, eigenfunctions of, 18: 26211
transport by materials, combined analytical and stochastic method for calculating, 18: 26823
ultrasonic attenuation in gas of, coulomb interaction effects in, 18: 26408

ELECTROSTATIC FIELDS

distribution in plasma, correlation functions for, 18: 26750

ELECTROSTATIC GENERATORS

design for multiply charged positive ion beams, 18: 26186(P)

ELEMENTARY PARTICLES

bound states of, in full symmetry theory, 18: 26361
classification of, in four baryon-lepton scheme, 18: 26367
classification of, in four baryon-lepton scheme, 18: 26368
conference on weak interactions, 18: 26260 (BNL-837)
decay of strongly interacting, leptonic, 18: 26272 (BNL-837(p.299-302))
field theory for, Kemmer algebras and unitary groups for, 18: 26303
interactions in field theory, peratization methods and singular potentials for, 18: 26407
interactions of three-body systems of, angular momentum separation in amplitudes for, 18: 26336
interactions of, bosons (W) and universality in weak, 18: 26270 (BNL-837(p.266-74))
interactions of, construction of SU(3) representations of, 18: 26355
interactions of, equivalence of Feynman and field theoretic formalisms of, 18: 26398
interactions of, field theory for weak, 18: 26267 (BNL-837(p.237-48))
interactions of, Lorentz invariant S-matrix amplitudes in, 18: 26294
interactions of, lepton charge in weak, 18: 26309
interactions of, mass breaking asymmetry in, 18: 26335
interactions of, optical theorem for exchanged quantum numbers in, 18: 26337
interactions of, partial wave singularities and elastic scattering amplitude in, 18: 26322
interactions of, renormalization for parity-conserving, 18: 26314
interactions of, symmetry induction in strong, 18: 26327
interactions of, S-matrix poles near threshold of, 18: 26330
interactions of, theory of weak, 18: 26362
interactions of, wave functions for hard-core, 18: 26306
interactions with derivative coupling, reduction formulas for, 18: 26313
interactions, phenomenological analysis of relativistic three-particle emission, 18: 26384
invariance in SU(3) octet, test of R-reflection, 18: 26366
mass of Z^- particle of unitary symmetry model, 18: 26315
models for, basic Su(3) triplets with integral charge in, 18: 26324
models for, trio-invariant symmetry in, 18: 26325
models of, Jost-function analyticity for coulomb potential in, 18: 26311
parity of, spin-zero photoproduction determining, 18: 26310
quantized field of unstable, formulation of, 18: 26429
reduction coefficients for septet irreducible representation of G_2 symmetry, triple-product, 18: 26316
scattering in finite bodies, theory of multiple, 18: 26307
scattering on mass shells, energy-dependent potentials in, 18: 26410
scattering, analytic properties of partial wave amplitudes in elastic, 18: 26383
scattering, effects of final state interactions on, 18: 26379

ELEMENTS

abundances and isotopic compositions in meteorites, review on, 18: 26201

EMBRYOS

radiation effects on oxygen consumption of intestine of chicken, 18: 25124
radiation effects on nucleic acid metabolism in barley seed, 18: 25175
radiosensitivity of Drosophila, 18: 25143

EMISSION SPECTRA

oxyacetylene flame for, development of fuel-rich, premixed, 18: 25278

ENRICHED REACTORS

lattice parameters for heavy-water 2% enriched-uranium, 18: 26886

ENZYMES

content of diamine oxidase in plasma, effects of pregnancy on, in rats and humans, 18: 25086(R) (TID-20636)
radiation detection by tissue fluid flow as affected by hyaluronidase, 18: 25134
radiation effects on rat polysaccharide phosphorylase, x, 18: 25115
radiation effects on stomach histidine decarboxylase activity in rats, 18: 25086(R) (TID-20636)
radiation effects on activity of, in blood and liver of rats, 18: 25154
radioinduced mutation of xanthine dehydrogenase in Drosophila, effects on activity, 18: 25208

EQUATION OF STATE

derivation of Tonks' gas, 18: 26134
rigid sphere, compressibility and heat capacity calculations from, 18: 25367

ERBIUM

determination using Xylenol Orange, spectrophotometric, 18: 25285
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
magnetic moment of ions of, in crystalline state and in solution, 18: 25350
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26668
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
separation from scandium by cation exchange chromatography, 18: 25613
spectra in thorium oxide at 100°K, nephelauxetic effects on reflection, 18: 25423
Young's modulus, 18: 26006

ERBIUM ALLOYS

Er–Tb, magnetic transition temperatures in, 18: 25980(R) (ORNL-3582 (p.9-10))
Er–Y, magnetic properties of, 18: 25981(R) (ORNL-3582(p.11-16))

ERBIUM AZIDES

thermal decomposition of, differential thermal analysis of, 18: 25446

ERBIUM IONS

spectrum of trivalent, in calcium fluoride matrix, 18: 25359

ERBIUM ISOTOPES Er-152

alpha decay of, energies and rates for, 18: 26640

ERBIUM ISOTOPES Er-166

energy levels of, fair-quasiparticle state in high, 18: 26632

ERBIUM ISOTOPES Er-170

oxygen-16 fission at 120 to 165 Mev, energy-mass distributions in, 18: 26558 (UCRL-11377)

ERBIUM NIOBATES

fluorescence spectra, 18: 26017
$CaMoO_4$–$ErNbO_4$, preparation and spectra of, 18: 26017
$CaWO_4$–$ErNbO_4$, preparation, luminescent properties, and structure of,

18: 26017
ERBIUM SYSTEMS
B–C–Er, phase studies, 18: 25319 (COO-1140-103)
ERYTHROCYTES
effects of X agent on, 18: 26144
rubidium-86 uptake by, in controls and cancer patients, 18: 25074
ERYTHROPOIESIS
effects of erythropoietin content of blood on, 18: 26988 (TID-20635)
radiation effects of ultraviolet light on, in rats, 18: 25160
ERYTHROPOIETIN
blood content of, effects of anemia and other factors on, in man and animals, 18: 26988 (TID-20635)
ESCHERICHIA COLI
radiation effects on pyridoxal phosphate in, x, 18: 25103
radiation effects on, dark repair during thymine deprivation of, 18: 25221
radiation effects on, effects of oxygen on reparation of, 18: 25229
radioinduced cross-induction in, mechanism of uv, 18: 25210
radioprotective effects of polysaccharide fraction from, 18: 25218
ETHANE
photochemistry of deuterated and natural, 18: 25561
reactions of deuterated, with hot hydrogen atoms, 18: 25597
reactions with hot deuterium atoms, 18: 25597
ETHANE, 1,2-BIS(2-CHLOROETHOXY)-
solvent properties for plutonium, 18: 25603 (CEI-18)
ETHANE, DIBROMO-
reactions with ammonia, production of carbon-deuterated ethylenediamine dihydrobromide by, 18: 25458
ETHANETHIOL, 2-AMINO-
preparation by irradiation of cystamine, effects of oxygen on, 18: 25542
protective effects against genetic effects of x radiation on rats, 18: 25215(T) (AEC-tr-6227/1(p.25-44))
ETHANOL
additive effects on radioinduced graft polymerization of polypropene to acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, 18: 25505(T) (AEC-tr-6372(p.363-9))
additive effects on radioinduced graft polymerization of polypropene on acrylonitrile, 2-methyl-5-vinyl pyridine and styrene, 18: 25506(T) (AEC-tr-6372(p.371-7))
effects on electrolytic precipitation of nickel alloys, 18: 26057
effects on ion exchange of uranium and other elements in system with organic acids, 18: 25305
effects on radioinduced graft polymerization of celluloses on styrene, 18: 25474(T) (AEC-tr-6372(p.83-8))
electric conductivity of anhydrous uranyl nitrate in, 18: 25394
radiolysis of liquid, mechanism of hydrogen formation in gamma, 18: 25589
radiolysis of, free radical yields in gamma, 18: 25538
benzene–ethanol, yields in gamma radiolysis of, 18: 25545
ethanol–$NdCl_3$, solvent properties for lanthanum, 18: 25620
ethanol–HCl, sorption of thorium and uranium by ion exchange from, 18: 25383
ETHYL ACETATE
effects on hydrogen yields in radiolysis of liquid ethanol, 18: 25589
ETHYL ETHER
effects on dielectric properties of butyllithium, 18: 25452
radioinduced polymerization with dimethylketene, products and reactivity of, 18: 25494(T) (AEC-tr-6372(p.237-46))
ETHYL SULFATES
genetic effects in oats, 18: 25184
ETHYLAMINE, 2,2'-DITHIOBIS-
effects on genetic recombination in Sordaria, 18: 25222
radiolysis of, formation of cysteamine by, 18: 25542
ETHYLENE
radioinduced polymerization in presence of titanium tetrachloride, 18: 25508(T) (AEC-tr-6372(p.387-95))
radioinduced reaction with acetaldehyde, pressure and temperature effects on, 18: 25509(T) (AEC-tr-6372(p.397-404))
radiolysis of, spectral studies on gamma, 18: 25588
ethylene–2-propanol, formation of amyl alcohol by beta radiation telomerization of, 18: 25511(T) (AEC-tr-6372(p.413-19))
ETHYLENE, CHLORO- POLYMERS
diffusion of deuterium, hydrogen, and tritium through, 18: 25706 (AWRE-O-17/62)
radioinduced chlorination of, rate and spectra of, 18: 25504(T) (AEC-tr-6372(p.349-61))
radioinduced polymerization with triallylcyanurate, 18: 25569
ETHYLENE, DICHLORO- POLYMERS
formation in radioinduced chlorination of polyvinyl chloride, properties and spectra of, 18: 25504(T) (AEC-tr-6372(p.349-61))
radioinduced polymerization of *cis*- and *trans*-, 18: 25491(T) (AEC-tr-6372(p.207-12))
ETHYLENE, DIFLUORO- POLYMERS
radiation effects on, ESR spectra of free radicals formed in, 18: 25531(T) (AEC-tr-6372(p.563-74))
ETHYLENE, FLUORO- POLYMERS
radiation effects on, ESR spectra of free radicals formed in, 18: 25531(T) (AEC-tr-6372(p.563-74))
ETHYLENE GLYCOL
radiation chemistry of, 18: 25574
air-ethylene glycol, theory of two-phase annular flows of, 18: 25657(R) (NYO-3114-1)
ETHYLENE GLYCOL POLYMER ETHERS
radiation effects on spectra of, at low temperature, 18: 25515(T) (AEC-tr-6372(p.445-53))
ETHYLENE POLYMERS
formation in radioinduced polymerization of ethylene in presence of titanium tetrachloride, 18: 25508(T) (AEC-tr-6372(p.387-95))
neutron scattering by, dose measurements in small-volume, 18: 26532 (NAA-SR-9418)
radiation effects on reactions with chlorine and sulfur dioxide, 18: 25490(T) (AEC-tr-6372(p.197-205))
radiation effects on crystal state and ESR spectra, 18: 25529(T) (AEC-tr-6372(p.547-54))
radiation effects on, ESR spectra of capture domains of free radicals in, 18: 25532(T) (AEC-tr-6372(p.577-86))
radiation effects on, ESR spectra of alkyl-type radicals formed in, 18: 25533(T) (AEC-tr-6372(p.587-92))
radioinduced graft polymerization on butadiene, butadiene–styrene, chloroprene, and isoprene, 18: 25484(T) (AEC-tr-6372(p.145-57))
radioinduced polymerization of *cis*- and *trans*-, 18: 25492(T) (AEC-tr-6372(p.207-12))
radioinduced thermoluminescence in, factors affecting, 18: 25471(T) (AEC-tr-6372(p.49-59))
spectra of irradiated, temperature effects on, 18: 25512(T) (AEC-tr-6372(p.421-30))
ETHYLENE, TETRAFLUORO- POLYMERS
radiation effects on doublet quintet ESR spectra of, 18: 25530(T) (AEC-tr-6372(p.555-62))
ETHYLENEDIAMINE
synthesis and spectra of carbon-deuterated dihydrobromide of, 18: 25458
ETHYLENEDIAMINE TARTRATES
x-ray fluorescence tables for dextro-, 18: 25449 (Y-1470-D)
EUROPIUM
determination using Xylenol Orange, spectrophotometric, 18: 25285
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
magnetic moment of ions of, in crystalline state and in solution, 18: 25350
magnetic structure, temperature variations of, 18: 26039
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
separation by solvent extraction using chelating acids, 18: 25622
solvent distribution in perchloric acid–TBP systems, 18: 25381
spectra in thorium oxide at 100°K, nephelauxetic effects on reflection, 18: 25423
EUROPIUM AZIDES
thermal decomposition of, differential thermal analysis of, 18: 25446
EUROPIUM CHLORIDES
complexes with 1,10-phenanthroline, structure and thermal stability of, 18: 25387
entropy of formation and vapor pressure over, 18: 25426
EUROPIUM COMPLEXES
with benzoylacetonate and dibenzoylmethide, laser properties of, 18: 25445

with β-diketone, spectra and quantum states of, in polymethylmethacrylate, 18: 25462
with bicarbonate and carbonate, ion exchange studies, 18: 25438
with hexafluoroacetylacetonate, luminescence of, 18: 25558
with Lewis bases, fluorescence properties, 18: 25455
EUROPIUM IONS
energy transfer effects and fluorescence in yttrium oxides, 18: 25564
EUROPIUM ISOTOPES Eu-152
beta decay of, $3^-(\beta)2^+$ transitions in, 18: 26607
EUROPIUM ISOTOPES Eu-154
beta decay of, $3^-(\beta)2^+$ transitions in, 18: 26607
EUROPIUM NIOBATES
fluorescence spectra, 18: 26017
$CaMoO_4$–$EuNbO_4$, preparation and spectra of, 18: 26017
$CaWO_4$–$EuNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
EUROPIUM NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
EUROPIUM OXIDES
reactions with oxides of cobalt, iron, nickel, and uranium, 18: 26896(R) (ANL-6868(p.133-74))
Eu_2O_3–UO_3, corrosion by steam at 650°C and water at 360°C, 18: 25919(R) (ANL-6868(p.190-200))
EUROPIUM PHOSPHATES
preparation and single crystal growth of ortho-, 18: 25356
EUROPIUM TANTALATES
fluorescence spectra, 18: 26017
EVAPORATORS
economic analysis of designs for, 18: 25643
EXHAUST SYSTEMS
requirements of, for high-level gamma installations, 18: 25718
EXPERIMENTAL BOILING WATER REACTOR
control rod and fuel element development and fabrication, 18: 26895(R) (ANL-6868(p.117-19))
fuel element testing, 18: 26898(R) (ANL-6868(p.188-9))
reactivity variations due to boiling in, minimization of, 18: 26924(R) (EURAEC-1065)
EXPERIMENTAL BREEDER REACTOR
design and operations, 18: 26824(R) (ANL-6885)
EXPERIMENTAL BREEDER REACTOR-II
design and operations, 18: 26824(R) (ANL-6885)
fuel element development and testing, 18: 26893(R) (ANL-6868(p.11-108))
EXPERIMENTAL GAS COOLED REACTOR
fuel element creep bowing in, analysis of, 18: 26938
EXPLODING WIRE PHENOMENA
plasma production and acceleration in, 18: 26809
plasma production in underwater, temperature of, 18: 26754
plasma production in detonation of gas mixtures by, 18: 26765
EXPLOSIONS
radiation protection of eyes during nuclear, 18: 25044
EXPLOSIVES
use in metal working, 18: 25955
EXPONENTIAL PILES
conference on exponential and critical experiments, 18: 26873
conference on exponential and critical experiments, 18: 26881
description of MINOR, for heavy-water lattice studies, 18: 26882
description of Netherlands PUK, 18: 26878
development at Victoria University of Manchester, England, 18: 26828
neutron active zones in heterogeneous, study using active and passive surface methods, 18: 26879
neutron buckling measurements for Queen Mary College of University of London assembly, 18: 26880
theory of fast-neutron, 18: 26877
EXTRUSION
bonding dissimilar metals by, 18: 25953
development for metal working, 18: 25955
EYES
inflammation in rabbit, treatment of, using thallium-204 beta source, 18: 25097(T) (JPRS-24936)
protection of, during fluoroscopic examinations, 18: 25249
radiation effects on, of dogs, 18: 25090(R) (UCD-472-109(p.45-8))
radiation effects on, protection against, 18: 25044
radiation effects on, 18: 25146
radiation effects on chicken corneal cells, 18: 25169
radiosensitivity, 18: 25249

F

FALLOUT
genetic effects of strontium-90 in, 18: 25697
mechanisms, 18: 25692
medical problems from, 18: 25730
monitoring in Arctic regions, 18: 25055 (NP-13985)
monitoring in Calcutta in 1960 to 1961, nuclear explosion dating from, 18: 25691
monitoring in Finland, 1961 to 1964, 18: 25687 (NP-13981)
monitoring in Finland, 1962 to 1964, 18: 25710 (NP-13984)
monitoring in Great Britain, 1963, 18: 25735
monitoring in Malaya, 1961 and 1962, 18: 25698
monitoring in Pacific Ocean, July, August, and November, 1961, 18: 25690
monitoring in U. S., 1962 and 1963, 18: 25694
monitoring in U. S., 1962, 18: 25265 (HASL-143)
monitoring in Venezuela, 1960 through 1962, 18: 25689
radiation exposure to young children from strontium-90 and iodine-131 from, in milk, 18: 25727
radiation hazards to man from chronic ingestion of strontium-90 from, 18: 25073
shelters, water supply for, 18: 25714
FAST REACTORS
corrosion and nuclear fission reactions in, 18: 25924
design of fail-safe, 18: 26889(P)
experiments and theory in, relation between, 18: 26827
fuel element development and testing, 18: 26893(R) (ANL-6868(p.11-108))
fuel processing methods for, 18: 26824(R) (ANL-6885)
fuels for, development of, 18: 26824(R) (ANL-6885)
isotope production in, economic value of, 18: 26927 (TID-20647)
neutron transport in, 22-group constants for, 18: 26824(R) (ANL-6885)
power transients in, coolant pressure transients from, 18: 26824(R) (ANL-6885)
FATTY ACIDS
radiation chemistry, 18: 25591
radioinduced oxidation, 18: 25570
FECES
excretion of iron-59 in, of man, 18: 25072
FERMIONS
interactions of four, field theory in, 18: 26267 (BNL-837(p.237-48))
interactions with photons, parity-determining boson-producing, 18: 26310
interactions with vector particles in field theory, model for, 18: 26390
pairing in metals, second-kind coherent, 18: 26426
FERROMAGNETIC MATERIALS
interactions in, Mössbauer effect for anisotropic hfs, 18: 26038
FIBRIN
synthesis in rat tumors, effects of enzymes and fibrinolysin inhibitor on, 18: 25068
FIBRINOGEN
selective deposition of iodine-131-labeled, in thyroid and tumors in rats, 18: 25068
FIELD THEORY
beta transitions in CVC, forbidden, 18: 26526 (BNL-837(p.340-3))
bound states and renormalization in quantum, 18: 26413
bound states in full symmetry theory, 18: 26361
bound states in quantum, 18: 26414
Einstein-Schrödinger relativistic unified, 18: 26388
elementary particles in, Kemmer algebras and unitary groups for, 18: 26303
elementary particle interactions in, penetrization methods and singular potentials for, 18: 26407
energy density in, commutation relation for canonical, 18: 26431
fermion interactions with vector particles in, model for, 18: 26390
formalism for weak-vector meson interactions, 18: 26329
formalism of free field conditions in quantum, 18: 26402

formalism of gravitation, commutators on characteristic surfaces in, 18: 26420
Green's functions for external fields, 18: 26386 (NP-13958)
interactions with derivative coupling, reduction formulas for, 18: 26313
invariance in SU(3) octet, test of R-reflection, 18: 26366
operators in fixed-source, asymptotic limits and regular perturbation of, 18: 26430
oscillators in quantum, quantization procedure for, 18: 26400
photon propagators in, charged vector boson effects on, 18: 26338
potentials in quantum, quasi-optical, 18: 26410
quantized free unstable particle field, 18: 26429
renormalization in stochastic theory, 18: 26437
scattering in, formalism for singular-potential, 18: 26415
space quantization in relativistic, 18: 26387(R) (ORNL-3582(p.41-5))
unified, identities in general relativity and, 18: 26389
wave equations for nonlocal solvable interactions in, Schroedinger, 18: 26404
weak interactions in, 18: 26267 (BNL-837(p.237-48))
FILMS
development of gauze, as electrodes in electron optics, 18: 26129
fabrication of superconducting, 18: 26496(P)
plasma acceleration from exploding, pulsed, 18: 26809
thickness of, equipment for beta backscatter measurement of, 18: 25769(P)
use of superconducting, in storage and switching devices, 18: 26477
FILTERS
analysis of absolute air, for uranium-235, nondestructive, 18: 25270 (NYO-10726)
properties for use in monitoring airborne radioactivity, evaluation of, 18: 26098 (NRL-6054)
FINLAND
cesium-137 content in diet and man of southern, 1961 to 1964, 18: 25687 (NP-13981)
cesium-137 content in Lapps, effects of diet on, 1962 to 1964, 18: 25710 (NP-13984)
fallout monitoring, 1959 to 1964, 18: 25055 (NP-13985)
FINNED TUBES
design with herringbone fin pattern, 18: 26913(P)
FIRE EXTINGUISHING AGENTS
fluoride mixture powder for plutonium, thorium, and uranium fires, 18: 25737(P)
FISH
liver ultrastructure after injection of thorium dioxide, 18: 25066
radionuclide uptake from water in pond, 18: 25079
FISSION
energy-mass distributions for light elements in liquid drop model, 18: 26558 (UCRL-11377)
properties of, in heavy and light nuclei, 18: 26608
FISSION CHAMBERS
design and construction of small, 18: 25860
design for in-pile neutron counting, 18: 25780(R) (GEAP-4604)
performance of helium in d-c, for neutrons, 18: 25777 (AEEW-M-395)
use in measurement of neutron spectral index in water-moderated homogeneous assemblies, 18: 26885
FISSION PRODUCTS
deposition from reactor gas coolant streams, heat/mass analogy for, 18: 26939
detection in gas-cooled reactors after fuel can failure, monitoring device for, 18: 26859(P)
detection of escape from fuel elements of, apparatus for, 18: 25856(P)
diffusion from coated and uncoated ceramic fuel particles, 18: 25983 (SGAE-ME-1/1964)
effects on graphite at high temperatures, 18: 25322 (GAMD-891(Rev.1))
from proton fission of uranium-238 at 45 and 150 Mev, 18: 26677
separation of tin-128 from, by solvent extraction using TTA, 18: 25274
shipping of, design evaluation of cask for, 18: 25707 (HW-65268(Rev.1))
shipping of, drop testing of cask for, 18: 25708 (HW-77962)
yields in helium ion fission of rhenium and thorium-232 at energies up to 40 Mev, 18: 26670
FISSION RECOILS
angular anisotropy, 18: 26627
FISSIUM
compatibility with refractory alloys and metals, 18: 26893(R) (ANL-6868 (p.11-108))
fissium–U, compatibility with type 304 stainless steel to 1200°C, 18: 26893(R) (ANL-6868(p.11-108))
fissium–Pu–U, fabrication and properties as reactor fuel, 18: 26893(R) (ANL-6868(p.11-108))
fissium–Pu–U, performance as fast reactor fuels, 18: 26824(R) (ANL-6885)
FLAMES
temperature measurement by thermal neutron scattering, 18: 26157
thermochemical calculations of temperature and composition of, 18: 25328(R) (SC-DC-64-864)
FLUID FLOW
analysis of two-phase, through nozzles, 18: 26824(R) (ANL-6885)
injection of fluid into, metering device for, 18: 26998(P)
magnetohydrodynamic, up vertical plate, 18: 26124
magnetohydrodynamic, past rigid bodies in aligned fields, 18: 26126
magnetohydrodynamic, in channels, 18: 26718
theory of two-phase annular, 18: 25657(R) (NYO-3114-1)
through heterogeneous partially saturated porous media, computer program for calculating, 18: 26975 (HW-72335(Pt.2))
two-phase pressure drop across thick plate restrictions in, 18: 25665
two-phase, expansion through convergent-divergent nozzle in, 18: 25662
void fraction in cavitating, radiometric measurement of, 18: 25663
FLUID FLOW (LAMINAR)
development in duct and tube entrance regions, analysis of, 18: 25668
transient forced convection from flat plate subjected to step energy input, 18: 25666
FLUID FLOW (TURBULENT)
conference, 18: 26152
FLUID FUEL REACTORS
channel element design for imparting tangential motion to fuel in circulating fuel, 18: 26857(P)
design using flow-produced fuel suspension, 18: 26888(P)
FLUIDIZATION
mixing of particulate solids in packed beds, movement in, 18: 25658
FLUIDS
injection into process stream, metering device for, 18: 26998(P)
neutron scattering by, 18: 26509
theory of electric charge, 18: 26416
theory on slip instability in viscous, 18: 25667
FLUORESCENCE
data tabulation for ethylenediamine dextrotartrate, 18: 25449 (Y-1470-D)
equipment for, use of radioisotope sources in portable x-ray, 18: 25275
radioinduced polarization of, in organic scintillation crystals, 18: 25594
radioinduced, stability of, in metaphosphate glass microdosimeters in dark storage, 18: 26076
spectral corrections for continuous-radiation-excited, electron probe microanalysis of, 18: 26105 (CEA-R-2421)
FLUORIDE VOLATILITY PROCESSES
development for separating plutonium and uranium fuels, 18: 26824(R) (ANL-6885)
FLUORINE
content in marine rocks in Israel, 18: 25686
corrosive effects on nickel at 450 to 500°C, 18: 26824(R) (ANL-6885)
nuclear hyperfine structure of, in lithium fluoride crystals, 18: 25414
reactions with tungsten, effects of metal form on rate of, 18: 25332(T) (UCRL-Trans-1044(L))
FLUORINE ISOTOPES F-17
beta-decay branching ratios in, 18: 26565
energy levels of, lifetime of first excited, 18: 26641
FLUORINE ISOTOPES F-18
production of carrier-free, method for, 18: 25875
FLUORINE ISOTOPES F-19
deuteron reactions (d,nγ) at 500 to 700 kev, coincidence measurements for, 18: 26574
deuteron reactions (d,α), theoretical and experimental angular distributions, 18: 26675
energy level structure, 18: 26601
energy levels of, negative-parity, 18: 26592
neutron reactions (n,γ) with, spectra from resonant, 18: 26541(R) (ORNL-3582(p.68-71))

proton reactions (p,α_0) at 2.0 to 3.3 Mev, angular distributions and cross sections for, 18: 26664
scattering by nuclei, strong absorption model for elastic, 18: 26563
FLUORINE SYSTEMS
F–HCl, corrosive effects on nickel at 450 to 500°C, 18: 26824(R) (ANL-6885)
F–O, corrosive effects on nickel at 450 to 500°C, 18: 26824(R) (ANL-6885)
FLUOROFORM
exchange between deuterium and hydrogen in methanol–sodium methoxide system, formation of perfluorocarbanions in, 18: 25451
FOOD
cesium-137 content of, in southern Finland, 1961 to 1964, 18: 25687 (NP-13981)
nutritional quality of survival, 18: 25714
radiation effects on fried bean curd, gamma, 18: 25138
radiation effects on flours, gamma, 18: 25139
FORGING
development for metal working, 18: 25955
FORMALDEHYDE
radioinduced polymerization with acrylonitrile, methyl methacrylate, and styrenes, kinetics of, 18: 25492(T) (AEC-tr-6372(p.213-22))
radiolysis of aqueous solutions of, reactions of hydrated electron in, 18: 25579
FORMAMIDE
effects on radioinduced graft polymerization of celluloses on styrene, 18: 25474(T) (AEC-tr-6372(p.83-8))
FORMIC ACID
effects on ion exchange of uranium and other elements in system with organic solvents, 18: 25305
radiolysis of aqueous solutions of, reactions of hydrated electron in, 18: 25579
FREE RADICALS
electron spin resonance spectra of, radioinduced in polyoxymethylene, 18: 25514(T) (AEC-tr-6372(p.437-43))
electron spin resonance spectra of, radioinduced in acrylic acid, 18: 25518(T) (AEC-tr-6372(p.465-71))
electron spin resonance spectra of, radioinduced in cyclopentadiene, 18: 25522(T) (AEC-tr-6372(p.493-4))
electron spin resonance spectra of uv effects on beta radioinduced, in cyclohexene, 18: 25523(T) (AEC-tr-6372(p.495-8))
electron spin resonance spectra of, radioinduced in polyfluoro- and polydifluoroethylene, 18: 25531(T) (AEC-tr-6372(p.563-74))
electron spin resonance spectra of capture domains of, radioinduced in polyethylene, 18: 25532 (AEC-tr-6372(p.577-86))
electron spin resonance of alkyl-type, radioinduced in polyethylene, 18: 25533(T) (AEC-tr-6372(p.587-92))
formation in gamma radiolysis of *n*-alcohols, 18: 25538
production and stabilization, 18: 25329 (TID-20645)
radioinduced addition to carbon-carbon bonds, 18: 25466 (AERE-R-4587)
radioinduced in flour, disappearance kinetics of, 18: 25123
FREQUENCY CONVERTERS
design for lifting motors of reactor control rods, 18: 25637(P)
FREQUENCY MODULATION
combination with magnetic field, in electron paramagnetic resonance spectrograph, 18: 25762
FROGS
radiation effects on excitability of heart in, electron, 18: 25098
radionuclide uptake from water in pond, 18: 25079
FUEL CELLS
properties, 18: 26255
FUELS
gasification of, radiometric analysis of, 18: 25874
FUMARIC ACID, DIETHYL ESTER
radioinduced polymerization of, kinetics of, 18: 25491(T) (AEC-tr-6372(p.207-12))
FUMARIC ACID, DIMETHYL ESTER
radioinduced polymerization of *cis*- and *trans*-, 18: 25491(T) (AEC-tr-6372(p.207-12))
FUNGI
genetic recombination in Sordaria, effects of cystamine, cysteine, and thiourea on, 18: 25222
FURNACES
design and operation of electron-beam-melting, 18: 25939(R) (ANL-6868 (p.201-18))
FUSED SALTS
electric conductivity measurement by direct-current technique, 18: 26018
electric conductivity measurement by direct-current technique, 18: 26019
electric conductivity measurement by direct-current technique, 18: 26020
properties as reactor materials, 18: 26937

G

GADOLINIUM
determination using Xylenol Orange, spectrophotometric, 18: 25285
electric and magnetic properties of single crystals of, 18: 26160
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
ion exchange behavior in organic solvents containing organic acids, 18: 25305
magnetic moment of ions of, in crystalline state and in solution, 18: 25350
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26668
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
separation from scandium by cation exchange chromatography, 18: 25613
Young's modulus, 18: 26006
GADOLINIUM ALLOYS
Al–Gd, structure of Gd_3Al_2, 18: 25989
Gd–Ge, structure of Gd_3Ge_2, 18: 25989
GADOLINIUM AZIDES
thermal decomposition of, differential thermal analysis of, 18: 25446
GADOLINIUM CHLORIDES
complexes with 1,10-phenanthroline, structure and thermal stability of, 18: 25387
GADOLINIUM HYDRIDES
electric conductivity, 18: 25363
GADOLINIUM IONS
electron paramagnetic resonance of trivalent, 18: 25416(T)
GADOLINIUM ISOTOPES Gd-148
alpha decay of, energies and rates for, 18: 26640
GADOLINIUM NIOBATES
fluorescence spectra, 18: 26017
$CaMoO_4$–$GdNbO_4$, preparation and spectra of, 18: 26017
$CaWO_4$–$GdNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
GADOLINIUM NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
$Gd(NO_3)_3$–HNO_3–H_2O–$Y(NO_3)_3$, phase studies, 18: 25434
GADOLINIUM OXIDES
reactions with uranium dioxides, 18: 26896(R) (ANL-6868(p.133-74))
Gd_2O_3–UO_2, corrosion by steam at 650°C and water at 360°C, 18: 25919(R) (ANL-6868(p.190-200))
Gd_2O_3–UO_2, crystal structure and phase studies, 18: 26896(R) (ANL-6868(p.133-74))
GADOLINIUM PHOSPHATES
preparation and single crystal growth of ortho-, 18: 25356
GADOLINIUM SULFATES
reduction of anhydrous, by carbon monoxide, 18: 25427
GADOLINIUM SYSTEMS
B–C–Gd, phase studies, 18: 25319 (COO-1140-103)
GADOLINIUM TANTALATES
fluorescence spectra, 18: 26017
GALACTOSE
oxidation by sodium chlorite tritium kinetic isotope effects in, 18: 25489
GALAXIES
hydrogen distributions in Milky Way, intensity and radial velocity of neutral, 18: 26191
quasi-stellar radio sources as spherical, in process of formation, 18: 26196
GALLIUM
analysis for copper by neutron activation, 18: 25300
preparation and properties of, book on, 18: 25905

sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
GALLIUM ALLOYS
Ga–Ta, crystal structure of, 18: 26043(T)
Ga–V, critical currents of superconducting, 18: 26464
GALLIUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
GALLIUM COMPOUNDS
analysis for copper by neutron activation, 18: 25300
GALLIUM ISOTOPES Ga-66
positron spectrum in, shape of $0^+ \rightarrow 0^+$ transition in, 18: 26669
GALLIUM ISOTOPES Ga-69
nuclear magnetic resonance in gallium-substituted yttrium iron garnet, 18: 25413
GALLIUM ISOTOPES Ga-71
neutron reactions (n,αn) with, cross sections for, 18: 25300
nuclear magnetic resonance in gallium-substituted yttrium iron garnet, 18: 25413
GALLIUM ISOTOPES Ga-72
beta decay of, $3^-(\beta)2^+$ transitions in, 18: 26607
GAMMA ABSORPTION COEFFICIENTS
measurement of, by application of radiation reciprocity principle in typical radiotherapeutic situations, 18: 25245
GAMMA RADIATION
absorption by soils, mass coefficients for, 18: 25700
absorption in solid fuel gasification, 18: 25874
angular correlations with protons inelastically scattered by zinc, 18: 26582
angular correlations in oxygen-16 inelastic scattering by selenium-76 and -78, 18: 26610
angular correlations of, analyses of, 18: 26637
angular correlations with neutrons in deuteron reactions (d,nγ) with boron-11 at 1.0 and 0.7 Mev, 18: 26680
biological effects in swine, 18: 25188
biological effects of, effect of dose fractionation on, 18: 25192
biological effects of low-intensity chronic doses of, on audiogenic seizure in mice and rats, 18: 25206
biological effects on synthesis of nucleic acid, protein, desoxyribonucleic acid, and ribonucleic acid by strain L cells, 18: 25209
chemical effects on air, 18: 25718
chemical effects on polyvinyl chloride–triallylcyanurate mixtures, 18: 25569
chemical effects on aerated and deaerated aqueous solutions of benzene, 18: 25464 (AE-142)
chemical effects on methane–oxygen mixtures, 18: 25465 (AERE-R-4581)
chemical effects on casein, 18: 25469 (SRIA-120)
chemical effects on propylamine, 18: 25552
chlorination of polyvinyl chloride induced by, rate and spectra of, 18: 25504(T) (AEC-tr-6372(p.349-61))
cytologic effects on leaf tissue nuclei, from irradiation of sugar beet seed, 18: 25136
detection and measurement of, optimum position of radiac detector in M60 tank for, 18: 25709 (NDL-TR-49)
detection and measurement of, efficiency of sodium iodide crystals for, 18: 25865
determination of dose rates from natural and fallout, in U. S., 1962 and 1963, spectrometric, 18: 25694
dose rates in shelters, effects of compartmentalization on, 18: 25712 (USNRDL-TR-722)
dose-time relations for, for therapy of laryngeal carcinomas, 18: 25250
dosimetry of collimated source of, application of radiation reciprocity principle to, 18: 25245
dosimetry of low-level, fluorescence apparatus for, 18: 25855(P)
dosimetry of, development of silicon photocells for, 18: 25833
effects on alkali borate glass, 18: 26079
effects on amides in carbon tetrachloride, 18: 25572
effects on atherosclerosis development in pigeons, 18: 25087(R) (TID-20641)
effects on behavior of mice, chronic, early exposure, 18: 25190
effects on benzene and its derivatives, ESR spectra of, 18: 25520(T) (AEC-tr-6372(p.481-90))
effects on cadmium and nickel electrodes, 18: 26067(R) (AI-8971)
effects on cadmium sulfide lattices, 18: 26088
effects on crystal state and ESR spectra of polyethylene, 18: 25529(T) (AEC-tr-6372(p.547-54))
effects on deformation of zinc single crystals, 18: 26090
effects on deuterated and nondeuterated benzene–cyclohexane, 18: 25566
effects on ESR spectra of 2-methylpropene, temperature effects on, 18: 25513(T) (AEC-tr-6372(p.431-5))
effects on ESR spectra of *l*-cysteine and *l*-cystine, dose rate effects on, 18: 25539
effects on ethylene glycol, chemical, 18: 25574
effects on fatty acids and other organic compounds, 18: 25591
effects on flour, 18: 25139
effects on fried bean curd, 18: 25138
effects on liver regeneration in mice, brief and prolonged, 18: 25122
effects on methionine and methionine derivatives, chemical, 18: 25573
effects on optical properties of rubies, 18: 26078
effects on polyethylene, ESR spectra of capture domains of free radicals in, 18: 25532(T) (AEC-tr-6372(p.577-86))
effects on polyfluoroethylene and polydifluoroethylene, ESR spectra of radicals formed in, 18: 25531(T) (AEC-tr-6372(p.563-74))
effects on polyoxymethylene at low temperature, mechanism of, 18: 25514(T) (AEC-tr-6372(p.437-43))
effects on potassium nitrates, mechanisms of luminescence induced in, 18: 25586(T)
effects on PVA, effects of boric acid on, 18: 25487(T) (AEC-tr-6372 (p.175-84))
effects on radical anisotropy in acrylic acid, ESR spectra of, 18: 25518(T) (AEC-tr-6372(p.465-71))
effects on reactions between chlorine and sulfur compounds and polymers, 18: 25490(T) (AEC-tr-6372(p.197-205))
effects on spectra of ethylene glycol polymers at low temperature, 18: 25515(T) (AEC-tr-6372(p.445-53))
effects on strongly alkaline anion exchange resins, 18: 25541
emission by indium-114 and -116, multipolarity of, 18: 26553(R) (ORNL-3582(p.115-17))
emission in compound-nucleus reactions forming polonium-210, 18: 26647
emission in tin-119 internal conversion, coefficients for, 18: 26642
fission of uranium-233 to 16 Mev, cross sections for formation of cesium-134 isomeric pair in, 18: 26585
genetic effects in cotton plants, 18: 25129
genetic effects in sorghum, 18: 25130
genetic effects in seeds of *Sorghum arundinaceum*, 18: 25131
genetic effects in barley, 18: 25176
genetic effects in oat seeds, effects of moisture content on, 18: 25181
graft polymerization of celluloses on styrene induced by, reactivity in, 18: 25475(T) (AEC-tr-6372(p.89-96))
graft polymerization of butadiene on celluloses induced by, properties of product in, 18: 25477(T) (AEC-tr-6372(p.103-8))
graft polymerization of celluloses on acrylonitrile–butadiene system induced by, rate of, 18: 25479(T) (AEC-tr-6372(p.117-23))
graft polymerization of acrylonitrile–butadiene and acrylonitrile–styrene on cellulose induced by, product composition in, 18: 25480(T) (AEC-tr-6372(p.125-7))
graft polymerization of butadiene on PVA induced by, effects of heat treatment on, 18: 25482(T) (AEC-tr-6372(p.135-40))
graft polymerization of PVA on styrene induced by, heat treatment effects on x-ray scattering in, 18: 25483(T) (AEC-tr-6372(p.141-3))
graft polymerization of polyethylene on butadiene, butadiene–styrene, chloroprene, and isoprene induced by, 18: 25484(T) (AEC-tr-6372 (p.145-57))
graft polymerization of acrylamide on PVA induced by, 18: 25485(T) (AEC-tr-6372(p.159-61))
graft polymerization of polypropene to acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, effects of additives and alpha pre-irradiation on, 18: 25505(T) (AEC-tr-6372(p.363-9))
graft polymerization of polypropene on acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, effects of additives and alpha pre-irradiation on, 18: 25506(T) (AEC-tr-6372(p.371-7))
graft polymerization of rayon on styrene induced by, conditions for, 18: 25534(T) (AEC-tr-6372(p.593-602))

induction of free radicals in flour by, disappearance kinetics of, 18: 25123
interactions with nucleons, polarization dependence of single meson (π) production in, 18: 26276 (DESY-64/6)
lethal dosage determinations of, for mice, 18: 25165
lethal effects on farina moth and nematodes, 18: 25125
lethal effects on HeLa cells in culture, effects of dose rate on, 18: 25187
measurement to 100 Mev, properties of ionization chambers for, 18: 25847
optical absorption bands induced in polystyrene, effects of oxygen on bleaching of, 18: 25568
pathological effects on heart of rabbits, 18: 25109
polymerization and thermoluminescence of β-propiolactone induced by, relation between, 18: 25498(T) (AEC-tr-6372(p.287-90))
polymerization effects on *cis*- and *trans*-vinylene monomers, 18: 25491(T) (AEC-tr-6372(p.207-12))
polymerization of acrylonitrile and styrene on viscose rayon induced by, solvent effects on graft, 18: 25476(T) (AEC-tr-6372(p.97-102))
polymerization of ketene induced by, products and reaction velocity of, 18: 25493(T) (AEC-tr-6372(p.223-35))
polymerization of dimethylketene with carbonyl compounds induced by, products and reactivity of, 18: 25494(T) (AEC-tr-6372(p.237-46))
polymerization of N-carboxy anhydrides of alanine and glutamic acid induced by, mechanism of, 18: 25495(T) (AEC-tr-6372(p.247-59))
polymerization of trioxane induced by, post-, 18: 25500(T) (AEC-tr-6372(p.299-310))
polymerization of 3,3-*bis*-chloromethylcyclobutane, diketene, β-propiolactone, and trioxane, crystal structure of polymers in, 18: 25501(T) (AEC-tr-6372(p.311-21))
polymerization of solid-state aldehydes, diketene, oxetanes, β-propiolactone, silicones and trioxanes induced by, epitactic, 18: 25502(T) (AEC-tr-6372(p.323-30))
polymerization of vinyl acetate in presence of iodine induced by, spectra of product in, 18: 25507(T) (AEC-tr-6372(p.379-85))
polymerization of ethylene induced by, in presence of titanium chloride, 18: 25508(T) (AEC-tr-6372(p.387-95))
polymerization of acrylonitrile with methyl methacrylate and styrene, 18: 25535(T) (AEC-tr-6372(p.603-12))
polymerization of liquid acrylamide induced by, effects of DPPH and oxygen on, 18: 25536(T) (AEC-tr-6372(p.613-16))
polymerization of vinyl acetate induced by, in liquid sulfur dioxide, 18: 25537(T) (AEC-tr-6372(p.617-25))
polymerization of acrolein induced by, temperature effects on products of, 18: 25546
reactions (γ,p) with nitrogen-14 at 15.5 to 30.5 Mev, 18: 26633
reactions between calcium fluoride and dysprosium induced by, 18: 25599
reactions between hydrogen sulfide and propene induced by, mechanism of, 18: 25550
reactions with thulium-doped calcium fluoride crystals, luminescence from, 18: 25571(T)
scattering at 662 kev, atomic number dependence of Rayleigh, 18: 26291
scattering at 662 kev, proton number dependence of Rayleigh, 18: 26292
scattering by concrete, iron, and lead at 0.66 Mev, 18: 26817
scattering by crystals, recoilless fraction for elastic nuclear-resonant, 18: 26657
scattering by crystals, electronic and nuclear-resonant, 18: 26658
scattering by iron-57, polarization effects in resonant, 18: 26535(R) (ORNL-3582(p.20-3))
scattering by lead, polarization in elastic, 18: 26293
spectra from aluminum-27 reactions (p,p' γ) and decay, 18: 26613
spectra in (n,γ) reactions, 18: 26611
spectra in paraffin, 18: 26820
sterilization of male mosquitoes by exposure to, 18: 25047
telomerization of acetaldehyde with cyclohexene or hexene induced by, products of, 18: 25510(T) (AEC-tr-6372(p.405-12))
therapeutic use of massive doses of, in treatment of cancer of urinary bladder, 18: 25244
therapy of carcinomas, protective effects of phenylbutazone in, 18: 25243
use for cavitating-Venturi void-fraction measurements, 18: 25663

GAMMA SHIELDING
buildup factors for shielding materials from coefficients of Taylor equation, 18: 26814(T) (ORNL-tr-80)

GAMMA SOURCES
detection of moving, scintillation detector array for, 18: 25851
development of promethium-147, for use in dental fluoroscopy, 18: 25234 (SGAE-IB/IA-2/1964)

GAMMA SPECTRA
measurements of analysis of reliability of matrix models and methods for, 18: 26120
production in neutron capture by nuclei, 18: 26666

GAMMA SPECTROMETERS
design for determining uranium-235 in reactor fuels, 18: 25269(R) (NLCO-905)
design for measuring gamma emission in neutron capture, 18: 26666
development, 18: 26992
stabilization of multichannel, digital methods for, 18: 25804 (NAS-NRC-Pub-1184(p.150-64))
use in determinations of gamma dose rates from natural and fallout sources in U. S., 1962 and 1963, 18: 25694

GAMMA SPECTROSCOPY
use in flow detection in thick samples, 18: 25676

GARIGLIANO POWER REACTOR
development in 1963, 18: 26919(R) (EUR-1803.i)
pressure vessel materials surveillance program for, 18: 26925 (GEAP-4423)

GAS COOLED REACTORS
boiler design for power plants using, 18: 26941
corrosion and nuclear fission reactions in, 18: 25924
design with horizontal fuel rods, 18: 26953(P)
feasibility of 300 Mw(e) heavy-water-moderated, economic and technical, 18: 26926 (TID-20605)
fission-product deposition from coolant streams of, heat/mass analogy for, 18: 26939
fuel element development for, heat transfer considerations in, 18: 26905
impeller replacement inside pressure vessel of, apparatus for, 18: 26838(P)
loading and unloading system for graphite-moderated, 18: 26839(P)
loading and unloading device, 18: 26843(P)
loading and unloading, transfer mechanism for, 18: 26862(P)
moderator support structure design, 18: 26842(P)
shutdown device for, 18: 26858(P)

GAS FLOW
in electric-arc heater coaxial flow discharge tube, hot-gas containment limits for, 18: 26687 (AEC-64-49)

GAS FLOW (TURBULENT)
conference, 18: 26152
Lagrangian properties of, effects of suspended particles on, 18: 25656 (NYO-2930-2)

GASEOUS DIFFUSION PLANTS
vacuum control techniques and methods used at French Pierrelatte, 18: 25682

GASEOUS IONS
recombination rates, 18: 26210

GASES
analysis by radioinduced ionization, development and evaluation of method for, 18: 25290
compressibilities and heat capacities of, calculation of, 18: 25367
dynamics of impurities in Bose, 18: 26406
electromagnetic wave interactions with ionizing shock waves in, in d-c magnetic fields, 18: 26125
force-on-the-wall calculations for one-dimensional dense, with intermolecular potentials, 18: 26110 (LADC-6438)
kinetic theory of electron, 18: 26748
mechanics of rarefied, 18: 26688 (ARL-64-60)
molecule interactions in, mixed pair correlation functions for, 18: 26133
oscillations in quantum generator, 18: 26434
particle interactions in hard-sphere, pair correlation functions for, 18: 26132
partition function for Tonks', isobaric, 18: 26134
shock diffraction in, analysis of, 18: 26124

shock propagation in, evolution of trans-Alfvenic, 18: 26122
shock wave attenuation in transverse magnetic field in ionized, 18: 26802
shock wave reactive Mach stems in, 18: 26137
shock-wave structure in, 18: 26786
sound propagation in polyatomic, disturbances in, 18: 26135
temperature measurement in hot, by thermal neutron scattering, 18: 26157
temperature measurement of, spectrometer for, 18: 25764(P)
transport properties of atomic, 18: 26136
ultrasonic attenuation in electron, effects of coulomb interactions on, 18: 26408

GASTROINTESTINAL TRACT
radiation dose to, in ruminants, from ingestion of insoluble radioisotopes, 18: 25142
radiation effects on water circulation in rat, 18: 25155
radiosensitivity of mouse, to fast neutron exposure, 18: 25165

GATING SYSTEMS
design for linear amplifier, 18: 25799 (NAS-NRC-Pub-1184(p.124-34))
design of transistorized linear, for biased amplifiers, 18: 25797 (NAS-NRC-Pub-1184(p.119-20))
use of series-parallel transistor switch as linear, 18: 25798 (NAS-NRC-Pub-1184(p.121-3))

GEIGER-MUELLER TUBES
care and maintenance of, 18: 25862
ionization fluctuations in low-pressure, 18: 25831

GELATIN
protective effects on leptospirosis antibody formation in irradiated rabbits, 18: 25228

GENETICS
effects of chromosome ploidy on cell multiplication, 18: 26982(R) (NYO-2462-1)
effects of genetic factors on radiosensitivity of barley seeds, 18: 25175
effects of strontium-90 in fallout on human populations, 18: 25697
recombination in Sordaria, effects of cystamine, cysteine, and thiourea on, 18: 25222

GEOLOGY
map of Paiute Ridge Quadrangle, Nye and Lincoln Counties, Nevada, 18: 26984 (TEI-826)
map of Skull Mountain Quadrangle, Nevada Test Site, 18: 26985 (TEI-845)

GEOMAGNETIC FIELDS
relation to sporadic E occurrence, 18: 26440
variations of, ionospheric electric currents from, 18: 26442
variations of, review of theories for, 18: 26456
variations of, sudden over-all, 18: 26447

GEOMAGNETIC STORMS
data tabulation, 18: 26453
effects on E- and F-layer irregularities, 18: 26441
effects on hydromagnetic wave emission by ionosphere, 18: 26449

GEOPHYSICS
geomagnetic micropulsations, hydromagnetic instability theory of, 18: 26794
neutron sources for use in, development of actinium–beryllium, 18: 25873

GERMANIUM
impurity scattering at 11°K in, cyclotron resonance line broadening from, 18: 26112 (NP-14017)
plastic deformation and internal friction of, effects of optical excitation on, 18: 25973 (ASD-TDR-63-605(Pt.II))
preparation and properties of, book on, 18: 25905
radiation effects at 40 and 440 Mev on transistors of, proton, 18: 26091

GERMANIUM ALLOYS
Dy–Ge, structure of Dy_5Ge_3, 18: 25989
Gd–Ge, structure of Gd_5Ge_3, 18: 25989

GIBBERELLIC ACID
effects on radiosensitivity of bean roots, 18: 25183

GLASS
fabrication for absorption of slow neutrons, 18: 25958(P)
radiation effects on alkali borate, gamma, 18: 26079
radiolysis of olefin, spectral studies on uv, 18: 25588
suspension in air, Lagrangian properties of turbulent flow of, 18: 25656 (NYO-2930-2)

GLASS TEXTILES
efficiency for liquid scintillation counting of carbon-14 and tritium, 18: 25839

GLOBULIN
protective effects of transfusions of, against radiation injuries in guinea pigs, 18: 25230

GLUCOSE
oxidation by sodium chlorite carbon-14 and tritium kinetic isotope effects in, 18: 25459
respiration of labeled, 18: 25063

GLUTAMIC ACID
radioinduced polymerization of N-carboxy anhydrides of, mechanism of, 18: 25495(T) (AEC-tr-6372(p.247-59))

GLYCERIDES
analysis for nickel in hydrogenated and nonhydrogenated, activation, 18: 25282

GLYCINE
radiolysis of aqueous, yields in, 18: 25584

GOATS
radiation dose to gastrointestinal tract in, from ingested insoluble radioisotopes, 18: 25142

GOLD
electron scattering by, 18: 26236
lattice parameters and thermal expansion of, x-ray diffraction study of, 18: 26109 (LA-2687)
melting point of, correlation with energy of motion of monovacancies, 18: 26037
melting temperature of, equations for calculating, 18: 25990
neutron activation of, absolute measurement of efficiency of neutron sources by, 18: 26505
neutron elastic scattering at 5.0 Mev, angular distributions, 18: 26671
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26671
proton elastic scattering at 180 Mev, strong absorption model for, 18: 26562
radiation effects on crystalline, 18: 26069(R) (ANL-6868(p.373-417))
use as heat dispersant in oxidation of uranium monocarbide powder, 18: 25420

GOLD ALLOYS
crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Au–Ag, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))
Au–Fe, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))
Au–Nb–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Au–Ni, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))
Au–Pd, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))
Au–Pt, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))
Cu–Au, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))

GOLD CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374

GOLD ISOTOPES
energy levels of odd-mass, internal-conversion, 18: 26630

GOLD ISOTOPES Au-197
helium-4 fission at 70 Mev, energy-mass distributions in, 18: 26558 (UCRL-11377)

GOLD ISOTOPES Au-198
neutron capture by, gamma spectra and giant resonances in, 18: 26611
tissue distribution and dosimetry of, after intraperitoneal injection, 18: 25071

GONADS
iodine-131 distribution in human ovaries, 18: 25120
radiation effects on function of, in women, 18: 25196
radiation effects on, of bulls, 18: 25185
radiosensitivity, 18: 25241
radiosensitivity of, in man, 18: 25247

radiosensitivity of male, in guinea pigs, 18: 25191
shielding of, review, 18: 25046
tritiated thymidine uptake by mouse testes, dose-effect measurements of, 18: 25069
GRAPHITE
corrosion by carbon dioxide, 18: 26095
crystal lattice force constants of, theory for, 18: 25997
crystal lattice vacancies in, 18: 26016
development as structural material, review on engineering and metallurgical, 18: 25901
diffusion of nitrogen in, counter, 18: 26061
effects of fission products on, at high temperatures, 18: 25322 (GAMD-891(Rev.1))
galvanomagnetic properties of, pressure and temperature dependence of, 18: 26040(T)
impregnation with molten metal, 18: 25957(P)
oxidation at 420 to 530°C, mechanism and activation energy of, 18: 25923
oxidation in nitric oxide and oxygen, kinetic anisotropy in, 18: 25932
production of boron-free, 18: 25915(P)
radioinduced dimension changes in, fast neutron, 18: 26095
radioinduced stresses in, 18: 26034
reactions with steam, catalytic effects of barium, cesium, and strontium on, 18: 25321 (GA-5215)
thermal stresses in anisotropic hollow cylinders of, 18: 26116 (WADD-TR-61-72(Vol.XIX))
GRAPHITE ELECTRODES
preparation, properties, and uses of indicating, 18: 25320 (COO-1148-84)
GRAPHITE MODERATED REACTORS
corrosion and nuclear fission reactions in, 18: 25924
loading and unloading system for gas-cooled, 18: 26839(P)
moderator core structure design for compensation of Wigner growth, 18: 26841(P)
moderator structure design, 18: 26836(P)
GRASS
radioinduced mutations of, 18: 25177
GRAVITATION
energy of Schwarzschild exterior field, 18: 26395
field theory of, commutators on characteristic surfaces in, 18: 26420
particle motion under, equations for point, 18: 26391
radiation in nonempty space-time, representation of, 18: 26394
wave equations in fields of, Dirac, 18: 26403
GREAT BRITAIN
strontium-90 content of bone samples, collected during 1963, 18: 25735
GROUND WATERS
flow from Lake McMillan to Major Johnson Springs, Eddy County, New Mexico, tracer studies of, 18: 25684 (TEI-839)
flow measurements using radioisotopes, 18: 25699(T) (OTS-63-11008 (p.15-21))
radium and thorium contents of Egyptian, 18: 25696
GUINEA PIGS
content of injected iodine-131 in trachea of, effects of thyroidectomy on, 18: 25062
neodymium oxide inhalation by, pathogenetic study of, 18: 25078
radiation effects on response of, to Brucella vaccine, 18: 25096(T) (JPRS-24896)
radiation effects on lymph node morphology and desoxyribonucleic acid content in, 18: 25102
radiation effects on fertility of male, 18: 25191
radiation effects on lymphocyte segment index in, 18: 25203
radiation effects on fertility of, 18: 25230

H

HAFNIUM
crystal structure and phase studies, 18: 25968(R) (ANL-6868(p.267-86))
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
preparation and properties of, book on, 18: 25905
production in U. S., 18: 25908
reactions with hydrogen peroxide in alkaline solutions, properties of product in, 18: 25379
HAFNIUM ALLOYS
Hf–Nb, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Hf–Os–Zr, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Hf–Re–W, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Hf–Re–Zr, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Hf–Ta–W, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Hf–Zr, crystal structure and phase studies, 18: 25968(R) (ANL-6868 (p.267-86))
Hf–Zr, elastic properties at 4 to 600°K, 18: 25968(R) (ANL-6868 (p.267-86))
HAFNIUM CARBIDES
crystal structure, 18: 25970(R) (ANL-6868(p.303-25))
thermal diffusion at 1300 to 2500°C, 18: 25986 (WADD-TR-60-581(Pt.IV))
HAFNIUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
HAFNIUM COMPLEXES
with β-hydronaphthazarin and naphthazarin, formation constants and spectra of, 18: 25456
HAFNIUM ISOTOPES Hf-175
transition spectra in, Alaga's rules for electromagnetic, 18: 26628
HAFNIUM ISOTOPES Hf-177
energy levels of, half life of 113-kev, 18: 26655
transition spectra in, Alaga's rules for electromagnetic, 18: 26628
HALDEN BOILING REACTOR
control rod worths for second fuel charge, 18: 26948
void reactivity effects in second fuel charge, simulated experiments for, 18: 26947
HANDBOOKS AND MANUALS
indexes to ORNL master analytical manual, 18: 25271 (TID-7015 (Indexes)(Rev.1))
on ORNL Radioisotopes Procedures, 18: 25607 (ORNL-3633)
HANFORD PRODUCTION REACTORS (N)
cooling system design, 18: 26950
data recording and processing system for, 18: 26955 (HW-80188)
HARWELL SYNCHROTRON
use of Atlas computer on-line with, 18: 25880 (NAS-NRC-Pub-1184 (p.247-54))
HASTELLOY X
compatibility with fissium–plutonium–uranium alloys at 600 and 650°C, 18: 26893(R) (ANL-6868(p.11-108))
HEAD
protective effects of screening of, against radiation sickness in rats, 18: 25225
HEART
blood circulation in, tracer study on effects of anesthesia on, in dogs, 18: 25040
blood circulation in, tracer studies using krypton-85, in man and dogs, 18: 25042
buffer distribution in isolated perfused rat, tracer study of, 18: 25041
radiation effects on excitability of frog, electron, 18: 25098
radiation effects on rabbit, pathological, 18: 25109
HEAT EXCHANGERS
design of multitubular, 18: 25672(P)
surface cleaning and passivation, 18: 25914(P)
HEAT TRANSFER
burnout heat transfer in fog-cooled 19-rod fuel element, 18: 26900 (HW-80523(Rev.1))
in boiling, surface parameters affecting, 18: 25670
in development of fuel elements for gas cooled reactors, 18: 26905
in saturated nucleate pool boiling, 18: 25671
in vapor-heated heat exchanger with arbitrary timewise-variant flow perturbation, transient, 18: 25664
to liquids below critical point, effects of oscillations on, 18: 26824(R) (ANL-6885)
HEAT TRANSFER SYSTEMS
design for liquid sodium, 18: 25661
HEATERS
design for pressure vessels, 18: 26954(P)
HEAVY WATER REACTORS
feasibility of 300 Mw(e) gas-cooled, economic and technical, 18: 26926 (TID-20605)

shutdown residual power of, calculation of, 18: 26864 (EUR-548.f)
HELIUM
analysis for impurities, instruments for, 18: 25264 (CNLM-4016)
bubble release and swelling in solids, model for, 18: 26080
charge transfer with protons, cross sections for Lyman alpha emission from, 18: 26235
content and isotopic composition in stone meteorites, radiogenic, spallogenic, and primordial, 18: 26197
diffusion in latex and neoprene, 18: 25315 (AWRE-O-56/57)
diffusion of weakly-ionized plasma of, in magnetic field, 18: 26768
flow of liquid II, through narrow channels, 18: 26492
helium metastable atom scattering by, angular dependence of cross sections, 18: 26237
hyperon (Σ^-) reactions with, distributions of hyperons (Λ) from, 18: 26278(R) (ORNL-3582(p.129))
ionization by protons, electron-capture cross sections in, 18: 26227
lifetime of metastable atoms of, effects of impurities on, 18: 26238
meson (K^-) scattering by, resonance effects in, 18: 26277(R) (ORNL-3582(p.127-8))
performance in d-c ionization chamber for neutron detection, 18: 25777 (AEEW-M-395)
plasma of, production in cascade arc heater, 18: 26687 (ARL-64-49)
potential curve of metastable He molecule, 18: 26155
scattering of metastable atoms of, by helium and neon, angular dependence of cross sections, 18: 26237
spectra in plasma, fine structure of line, 18: 26219
spectra of pulsed plasma of, electron optics for recording, 18: 26743(T)
superheat in nucleate boiling of, 18: 26461
use as tracer in diffusion study of Lagrangian gas turbulence, 18: 25656 (NYO-2930-2)
use of liquid, in scintillator, 18: 25849
vibrations of quantized vortices in liquid II, 18: 26483
HELIUM IONS
angular distributions in oxygen-16 (p,He-3) reactions, 18: 26653
fission of rhenium and thorium-232 by, at energies up to 40 Mev, product yields, 18: 26670
fission of uranium-233, -235, and -238 at 20 to 42 Mev, cross sections for formation of cesium-134 isomeric pair, 18: 26585
ionization of argon by 8 to 100 kev, 18: 26217
reactions (He-3,t) of, optical model and distorted wave analysis of, 18: 26596
reactions with hydrogen molecules at 5 to 35 kev, excitation of Balmer spectral lines in, 18: 26214(T)
HELIUM ISOTOPES He-2
existence, 18: 26533 (NP-13974)
HELIUM ISOTOPES He-3
deuteron reactions (d,t) at 27 Mev, diproton existence from, 18: 26533 (NP-13974)
energy and magnetic rigidity of singly ionized, tables of, 18: 26232
meson (μ^-) capture, coupling constants in, 18: 26523 (BNL-837(p.292-7))
properties, 18: 25325 (MLM-1161)
reactions (He-3,t) of, optical model and distorted wave analysis of, 18: 26596
reactions (^{3}He, p) with deuterium at 32 Mev, helium-4 energy levels from, 18: 26528 (BNL-7983)
reactions with beryllium-9 and carbon-14, 18: 26549(R) (ORNL-3582 (p.100-1))
scattering by metals at 20 Mev, differential cross sections of elastic, 18: 26681
scattering by nuclei, strong absorption model for elastic, 18: 26563
theory of liquid, Landau, 18: 26468
thermodynamic properties of liquid, below 1°K, 18: 25439
HELIUM ISOTOPES He-4
binding energy in $^4He_\Lambda$, 18: 26591
binding energy in $^4He_\Lambda$, 18: 26622
energy levels, 18: 26528 (BNL-7983)
meson (μ^-) capture, coupling constants in, 18: 26523 (BNL-837(p.292-7))
meson (μ^-) reactions with, 18: 26524 (BNL-837(p.309-13))
mesons (K^-) reactions, $_\Lambda H^4$ lifetime from, 18: 26527 (BNL-837(p.454-6))
properties, 18: 25325 (MLM-1161)
properties of solid γ-phase, 18: 26485
proton elastic scattering at 31 Mev, 18: 26604
proton reactions (p,d) at 31 Mev, 18: 26604
reactions (^{4}He,f) with bismuth-209 and gold-197 at 65 and 70 Mev, energy-mass distributions in, 18: 26558 (UCRL-11377)
vapor pressure scale from 1.36 to 2.16°K, equation for, 18: 25349
HELIUM ISOTOPES He-5
binding energy in $^4He_\Lambda$, 18: 26591
HELIUM SYSTEMS
He–H, electron ionization coefficients, 18: 26220
HEMATOPOIETIC SYSTEM
distribution of hematopoietic marrow in patients with blood dyscrasias or cancer, radioisotope scanning of, 18: 25238
radiosensitivity, 18: 25220
radiosensitivity of mouse, to fast neutron exposure, 18: 25165
sensitivity to tumor chemotherapeutic agents, 18: 25220
HEPTANE, FLUORO-
exchange between deuterium and hydrogen in methanol–sodium methoxide system, formation of perfluorocarbanions in, 18: 25451
HEPTENE
radiolysis of, spectral studies on gamma, 18: 25588
3-HEPTENE, 3-METHYL-
radiolysis of, spectral studies on gamma, 18: 25588
HETEROGENEOUS REACTORS
design for stabilized operation, 18: 26887(P)
neutron active zones in, study using active and passive surface methods, 18: 26879
neutron resonance capture in fuel elements of, variational principle for, 18: 26870
1-HEXADECENE
radiolysis of, spectral studies on gamma, 18: 25588
1-HEXADECYNE
radiation effects on, ESR spectra of uv effects on beta, 18: 25524(T) (AEC-tr-6372(p.499-501))
HEXANE
effects on yields in radiolysis of α- and p-toluenethiol, 18: 25549
radioinduced ionization, 18: 25555
yields in gamma radiolysis of squalane at –196 to 350°C, 18: 25551
2,4-HEXANEDIONE
complexes with lanthanum, neodymium, praseodymium, and yttrium, stability of, 18: 25389
HEXENE
radiolysis of, spectral studies on gamma, 18: 25588
yields in gamma radiolysis of squalane at –196 to 350°C, 18: 25551
acetaldehyde–hexene, radioinduced telomerization of, 18: 25510(T) (AEC-tr-6372(p.405-12))
HEXYLAMINE, *N*-BENZYL-2-ETHYL-
solvent properties for uranium, 18: 25621
HEXYLAMINE, *N*-CYCLOHEXYL-2-ETHYL-
solvent properties for uranium, 18: 25621
HIGH-ALTITUDE EXPLOSIONS
radiation belts produced by Soviet 1962 thermonuclear, 18: 26188 (SUI-63-37)
HIROSHIMA
biological effects of atomic explosion on population of, 18: 25722
leukemia occurrence in bomb survivors in, 18: 25728
HOLMIUM
determination using Xylenol Orange, spectrophotometric, 18: 25285
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
magnetic moment of ions of, in crystalline state and in solution, 18: 25350
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
spectra in thorium oxide at 100°K, nephelauxetic effects on reflection, 18: 25423
Young's modulus, 18: 26006
HOLMIUM ACETYLACETONATES
complexity constants of, determination of step-wise, 18: 25385
HOLMIUM ALLOYS
Al–Ho, phase studies of intermetallic compounds in, 18: 26036
Dy–Ho, magnetic transition temperatures in, 18: 25980(R) (ORNL-3582 (p.9-10))
Ho–Tb, magnetic transition temperatures in, 18: 25980(R) (ORNL-3582

(p.9-10))
Ho–Y, magnetic properties of, 18: 25981(R) (ORNL-3582(p.11-16))
HOLMIUM AZIDES
thermal decomposition of, differential thermal analysis of, 18: 25446
HOLMIUM ISOTOPES Ho-153
production by proton reactions on dysprosium at 68 and 87 Mev, cross sections for, 18: 26584
HOLMIUM ISOTOPES Ho-159
production by proton reactions on dysprosium at 33 Mev, cross sections for, 18: 26584
HOLMIUM ISOTOPES Ho-160
production by proton reactions (p,2n), (p,3n), and (p,4n) on dysprosium isotopes at 9 to 87 Mev, cross sections for, 18: 26584
HOLMIUM ISOTOPES Ho-161
production by proton reactions (p,n), (p,2n), and (p,3n) on dysprosium isotopes at 9 to 87 Mev, cross sections for, 18: 26584
HOLMIUM ISOTOPES Ho-162
production by proton reactions (p,n), (p,2n), and (p,3n) on dysprosium isotopes at 9 to 87 Mev, cross sections for, 18: 26584
HOLMIUM ISOTOPES Ho-165
proton scattering by, at 17.5 Mev, 18: 26537(R) (ORNL-3582(p.55))
HOLMIUM NIOBATES
$CaMoO_4$–$HoNbO_4$, preparation and spectra of, 18: 26017
$CaWO_4$–$HoNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
HOLMIUM SYSTEMS
B–C–Ho, phase studies, 18: 25319 (COO-1140-103)
HOMOGENEOUS REACTORS
neutron spectral measurements in water-moderated bare critical assemblies, 18: 26885
HYDRACRYLIC ACID, β-LACTONE
radioinduced polymerization of derivatives of, 18: 25497(T) (AEC-tr-6372(p.273-86))
radioinduced polymerization of, ion mechanism and thermoluminescence relation to, 18: 25498(T) (AEC-tr-6372(p.287-90))
radioinduced polymerization of, crystal structure of polymers produced in, 18: 25501(T) (AEC-tr-6372(p.311-21))
radioinduced polymerization of solid, epitaxy in, 18: 25502(T) (AEC-tr-6372(p.323-30))
radioinduced polymerization of, activation energy and kinetics of, 18: 25503(T) (AEC-tr-6372(p.331-47))
radioinduced solid state polymerization of, uv, 18: 25499(T) (AEC-tr-6372(p.291-7))
radioinduced thermoluminescence of, relation to polymerization, 18: 25498(T) (AEC-tr-6372(p.287-90))
HYDRAZIDES
acetyl, radiation chemistry of, distribution of carbon-14 in chemical products of N(n,p) ^{14}C reaction in, 18: 25556
HYDRAZINE
radiolysis of aqueous solutions of, mechanisms and reaction rates of, 18: 25583
HYDRAZYL, DIPHENYLPICRYL-
effects on beta radioinduced polymerization of styrene, 18: 25486(T) (AEC-tr-6372(p.163-73))
effects on radioinduced polymerization of liquid acrylamide, 18: 25536(T) (AEC-tr-6372(p.613-16))
effects on radiolysis of sulfur compounds in toluene, 18: 25548
HYDRIODIC ACID
effects of deuterated, on photo-oxidation of iodomethane, 18: 25587
photolysis of, 1849 Å, 18: 25560
photolysis, hydrogen and iodine quantum yields in, 18: 25597
HYDROBROMIC ACID
effects on metal ion adsorption on anion exchange papers, 18: 25374
effects on photo-oxidation of iodomethane, mechanism, 18: 25587
photolysis of deuterated and natural, 1849 Å, 18: 25561
photolysis, reactions of hot hydrogen atoms produced in, 18: 25597
HBr–TBP, solvent properties for cobalt, copper, manganese, nickel, and zinc, 18: 25382
HYDROCHLORIC ACID
analysis for arsenic, copper, and zinc, activation, 18: 25286
corrosive effects on niobium and vanadium, effects of acidity and current density on anodic, 18: 25929
effects on metal ion adsorption on anion exchange papers, 18: 25374
effects on reactions between hydrogen peroxide and plutonium, 18: 25390
reactions with technetium(VII), 18: 25352
ethanol–HCl, sorption of thorium and uranium by ion exchange from, 18: 25383
F–HCl, corrosive effects on nickel at 450 to 500°C, 18: 26824(R) (ANL-6885)
HCl–2-propanol, sorption of thorium and uranium by ion exchange from, 18: 25383
HYDRODYNAMICS
Taylor's stability problem in, secondary-flow velocity in, 18: 26139
HYDROFLUORIC ACID
HF–HNO_3, solvent properties for thorium dioxide–uranium dioxide powders, 18: 25608 (ORNL-TM-867)
HYDROGEN
abstraction by trifluoromethyl radicals, kinetics of, 18: 25261
additive effects on lifetime of metastable helium atoms, 18: 26238
binding to oxygen in water, isotopic substitution effects on, 18: 25417(T)
content in fabricated uranium, effects processing methods on, 18: 25943 (HW-30116)
determination in aqueous solutions by gas chromatography, 18: 25273(T) (AEC-tr-6227/1(p.9-14))
diffusion in latex and neoprene, 18: 25315 (AWRE-O-56/57)
diffusion through neoprene and polyvinyl chloride, 18: 25706 (AWRE-O-17/62)
diffusion through synthetic rubber gloves, 18: 25467 (AWRE-O-54/57)
distribution in galaxy, intensity and radial velocity of, 18: 26191
electron impact excitation of atomic, to 2s and 2p levels, 18: 26203 (NASA-TN-D-2145)
electron scattering by atomic, excitation of 2_p state in, 18: 26225
electrostatic fields in plasma of, correlation functions for, 18: 26750
exchange with deuterium in resorcinols and related compounds in alkaline solution, 18: 25453
exchange with deuterium in monohydrofluorocarbons in methanol–sodium methoxide system, formation of perfluorocarbanions in, 18: 25451
formation and detection in radiolysis of water, 18: 25576
formation in gamma radiolysis of liquid ethanol, mechanism of, 18: 25589
formation in pulsed electron beam radiolysis of aqueous solutions, rate constants for, 18: 25578
formation in radiolysis of polyoxymethylene at low temperature, mechanism of, 18: 25514(T) (AEC-tr-6372(p.437-43))
formation in radiolysis of toluene–sulfur solutions, 18: 25547
ion reactions at 5 to 35 kev, excitation of Balmer spectral lines in, 18: 26214(T)
ionization by protons, electron-capture cross sections in, 18: 26227
ionization by protons, exact-resonance electron-capture cross sections in, 18: 26228
ionization in pulsed discharge, role of dissociation in, 18: 26716
ionization of atomic, 2-photon, 18: 26218
meson (K^o-1) regeneration in, 18: 26264 (BNL-837(p.82-7))
meson (μ^-) capture, coupling constants in, 18: 26523 (BNL-837(p.292-7))
meson (μ^-) reactions with, 18: 26271 (BNL-837(p.277-91))
multipole expansion in electrodynamics of atomic, 18: 26392
nuclear spin of molecular, probability of spontaneous ortho-para transition, 18: 26153
ortho-para conversion rate in solid, 18: 25370
pinch discharge in, magnetic-probe studies of azimuthal, 18: 26735
plasma of, production in cascade arc heater, 18: 26687 (ARL-64-49)
positron interactions in plasma of, annihilation in, 18: 26789
radiation effects on agglomeration and diffusion of, in beryllium, 18: 26093
radiation effects on adsorption by alumina, 18: 25468 (BNL-845)
radio wave absorption profiles for expanding cloud of, 18: 26194
reactions of atomic, in irradiated aqueous solutions of single-carbon compounds, 18: 25579
reactions of hot atoms of, in photolyzed hydrobromic acid–gas mixtures, 18: 25597
reactions of photochemically produced, 18: 25560
reactions of photochemically produced, in deuterated ethane and methane and deuterium, 18: 25561

reactions with hot deuterium atoms, 18: 25597
separation of ortho-, from para-deuterium by sorption on gamma-alumina at 20.4°K, 18: 25442
spectra of solid, Q branch of infrared, 18: 25346
spin conversion of ortho-, with para-deuterium on alumina catalysts, 18: 25442
superheat in nucleate boiling of, 18: 26461
yields in gamma radiolysis of squalane at −196 to 350°C, 18: 25551
yields in radiolysis of acetone in aqueous solutions, acidity effects on, 18: 25582
yields in radiolysis of benzene–cyclohexane, 18: 25544
HYDROGEN ELECTRODES
isotopic effects in reactions on, equation for determining stoichiometric number of rate-determining step in, 18: 25400
HYDROGEN IONS
charge transfer to oxygen, cross section for, 18: 25377
dissociation of molecular vibrational excitation in collision-induced, 18: 26207
ionization of argon by 8 to 100 kev, 18: 26217
meson (μ^-) capture by protons in mu-mesic molecular, 18: 26555(R) (ORNL-3582(p.130))
wave functions of molecular, from atomic orbital expansions, 18: 26162
HYDROGEN ISOTOPES H-4
binding energy in $^4H_\Lambda$, 18: 26622
HYDROGEN ISOTOPES H-5
binding energy in $^5He_\Lambda$, 18: 26591
HYDROGEN PEROXIDES
formation and detection in radiolysis of water, 18: 25576
formation in pulsed electron beam radiolysis of aqueous solutions, 18: 25578
polarographic reduction in lanthanum solutions, 18: 25443
radiolysis of aqueous solutions of, kinetics of pulsed electron beam, 18: 25578
reactions with hafnium and zirconium in alkaline solutions, properties of products in, 18: 25379
reactions with plutonium in acid solutions, 18: 25390
yields in radiolysis of acetone in aqueous solutions, acidity effects on, 18: 25582
H_2O_2–NaOCl, chemiluminescence at 3000 to 7500 A, 18: 25371
HYDROGEN SELENIDES
spectra of selenium isotopes in, analysis of near-infrared, 18: 25437
HYDROGEN SULFIDES
formation in radiolysis of toluene–sulfur solutions, 18: 25547
radioinduced reactions with propylene, mechanism of, 18: 25550
HYDROGEN SYSTEMS
He–H, electron ionization coefficients, 18: 26220
H–Nb, structural phase studies on, 18: 26024
H–Ne, electron ionization coefficients, 18: 26220
H–O–Ti, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
H–Ta, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
H–U, critical mass and uranium density of, involving mutually insoluble compounds, 18: 25324 (K-1609)
H–Y, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
HYDROMAGNETIC WAVES
amplification and stability in slightly ionized plasma in magnetic field, 18: 26689 (BSD-TDR-64-34)
emission by ionosphere, fine structure in, 18: 26448
emission by ionosphere, effects of geomagnetic storms on, 18: 26449
propagation in a uniformly rotating fluid, 18: 26714
propagation in plasma cylinders, boundary conditions at insulating wall for, 18: 26728
HYDROXIDES
formation and detection in radiolysis of water, 18: 25576
HYDROXYL IONS
formation and detection in radiolysis of water, 18: 25576
HYDROXYL RADICAL
reactions in irradiated aqueous solutions of single-carbon compounds, 18: 25579
HYDROXYLAMINE
radiolysis of aqueous solutions of, mechanisms and reaction rates of, 18: 25583
HYDROXYLAMINES
solvent properties for americium and europium, 18: 25622
HYPERFRAGMENTS
binding energies of helium and hydrogen, 18: 26591
binding energy difference (^5He - $^4H_\Lambda$), 18: 26622
lifetime of $_\Lambda H^3$, 18: 26527 (BNL-837(p.454-6))
production in interactions of mesons (K^-) at 3 Bev/c with isotopic emulsion nuclei, 18: 26290
HYPERONS
decay amplitudes of, triangle relation for nonleptonic, 18: 26359
decay of Y_1^*, bootstrap calculations for, 18: 26332
decay of, leptonic, 18: 26274 (BNL-837(p.355-77))
production of Y_1^*, threshold effects in, 18: 26330
HYPERONS (Λ)
binding energies in hyperfragments, 18: 26591
binding energies in helium and hydrogen hyperfragments, 18: 26622
decay amplitudes of, triangle relation for nonleptonic, 18: 26359
decay of, branching ratio for leptonic, 18: 26272 (BNL-837(p.299-302))
interactions with protons, $_\Lambda H^3$ lifetime from, 18: 26527 (BNL-837(p.454-6))
interactions with nucleons, detection of resonances in, 18: 26277(R) (ORNL-3582(p.127-8))
interactions with protons, elastic-scattering cross sections in, 18: 26347
interactions with mesons (K^0), resonance effects in, 18: 26352
production in antiproton-deuteron interactions at 2.8 Bev/c, 18: 26334
production in hyperon (Σ^-) reactions with helium, distributions from, 18: 26278(R) (ORNL-3582(p.129))
production in meson (π)-nucleon interactions, models for, 18: 26281
trapping in nuclei, 18: 26623
HYPERONS (Λ^0)
decay of, leptonic, 18: 26274 (BNL-837(p.355-77))
HYPERONS (Σ)
decay of, branching ratio for leptonic, 18: 26272 (BNL-837(p.299-302))
decay of, leptonic, 18: 26274 (BNL-837(p.355-77))
interactions with mesons (π), resonance, 18: 26328
production in meson (π)-nucleon interactions, models for, 18: 26281
HYPERONS (Σ^-)
beta decay of, $\Delta S = \Delta Q$ rule in, 18: 26354
decay rate of, ($\pi^- + n + \gamma$), 18: 26262 (BNL-837(p.54-65))
production in antiproton-deuteron interactions at 2.8 Bev/c, 18: 26334
reactions with helium, distributions of hyperons (Λ) from, 18: 26278(R) (ORNL-3582(p.129))
HYPERONS (Σ^+)
beta decay of, $\Delta S = \Delta Q$ rule in, 18: 26354
decay amplitudes of, triangle relation for nonleptonic, 18: 26359
decay of, $\Delta S = \Delta Q$ violation in ($\mu^+ + \bar{\nu} + n$), 18: 26262 (BNL-837 (p.54-65))
decay rate of, ($\pi^+ + n + \gamma$), 18: 26262 (BNL-837(p.54-65))
parity and spin of, determination of, 18: 26343
HYPERONS (Ξ)
decay of, leptonic, 18: 26274 (BNL-837(p.355-77))
HYPERONS (Ξ^-)
decay amplitudes of, triangle relation for nonleptonic, 18: 26359
parity and spin of, determination of, 18: 26343
properties and decay of, 18: 26275 (BNL-837(p.410-26))
HYPERONS (Ω^-)
properties and decay of, 18: 26275 (BNL-837(p.410-26))

I

IMMUNE REACTIONS
radiation effects on mouse, x, 18: 25157
radiosensitivity of, in mice, 18: 25201
thymectomy effects on mouse, 18: 25157
IMMUNIZATION
protective effects of anti-leptospirosis, against radiation sickness in rabbits, 18: 25228
IMPELLERS
replacement inside pressure vessel of gas cooled reactors, apparatus for,

18: 26838(P)
IN-PILE LOOPS
design considerations for high-temperature liquid-metal-fuel, 18: 25634
design for TREAT, 18: 26824(R) (ANL-6885)
INCONEL
corrosion of 600, 625, and X750, by steam, 18: 26824(R) (ANL-6885)
INDANDIONES
substituted 2-(pyridyl) and 2-(quinolyl)-1,3-complexing tendencies of, 18: 25457
INDEXES
to ORNL master analytical manual, 18: 25271 (TID-7015(Indexes) (Rev.1))
INDIA
fallout monitoring in Calcutta in 1960 to 1961, nuclear explosion dating from, 18: 25691
INDIUM
preparation, properties, and uses of thin-film superconductors of, 18: 26476
proton elastic scattering at 180 Mev, strong absorption model for, 18: 26562
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
INDIUM ALLOYS
Bi–In, magnetic properties of superconducting, 18: 26495
Cd–In–Ag, radiation effects on microstructure, 18: 26897(R) (ANL-6868 (p.175-87))
In–Pb, surface impedance in superconducting, 18: 26489
In–Sn, surface impedance of superconducting, 18: 26467
Sb–In, carrier lifetime at high density in, 18: 26106 (D1-82-0306)
INDIUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
INDIUM ISOTOPES In-111
decay of, radiation damage in gamma angular correlations in, 18: 26085
INDIUM ISOTOPES In-114
gamma spectra of, multipolarities of, 18: 26553(R) (ORNL-3582(p.115-17))
INDIUM ISOTOPES In-116
gamma spectra of, multipolarities of, 18: 26553(R) (ORNL-3582 (p.115-17))
INDIUM PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
INFLAMMATION
radiation treatment of eye, in rabbits, use of thallium-204 beta source for, 18: 25097(T) (JPRS-24936)
INFORMATION RETRIEVAL SYSTEMS
data listing program for U.K.A.E.A. nuclear data library, 18: 25879 (AWRE-O-4/64)
INFRARED RADIATION
absorption by crystal lattices, line shapes for quantum, 18: 26130
development to nondestructive testing, 18: 25675(R) (ANL-6868(p.219-28))
INFRARED SPECTROMETERS
design for isotopic analysis of heavy and light water, 18: 25312(P)
relay selector for isotopic analysis of heavy and light water, 18: 25313(P)
INJECTIONS
of fluid into process stream, metering device for, 18: 26998(P)
INSECTS
radiation effects on eggs, larvae, and chrysalis of farina moth, gamma, 18: 25125
radiation effects on salivary gland chromosomes of *Chironomus tentans* larvae, 18: 25212
INSTRUMENTATION
conference on instrumentation techniques in nuclear pulse analysis, 18: 25781 (NAS-NRC-Pub-1184)
INSTRUMENTS
design for measurement of low surface temperatures, 18: 26992
design of modular, compatibility requirements for, 18: 25814 (NAS-NRC-Pub-1184(p.210-11))
for determination of argon and helium purity, 18: 25264 (CNLM-4016)
nuclear, care and maintenance of, 18: 25862
INTERMETALLIC COMPOUNDS
crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
magnetic susceptibility and nuclear magnetic resonance in, 18: 26522(R) (ANL-6868(p.326-30))
INTERMOLECULAR FORCES
force field parameters from isotope effects in phase equilibria, 18: 25373
INTERNAL CONVERSION
coefficients for tin-119, 18: 26642
distributions from, in indium-114 and -116, 18: 26553(R) (ORNL-3582 (p.115-17))
INTESTINE
radiation effects on oxygen consumption by embryonic, 18: 25124
IODIDES
alkyl, isotope exchange with sodium iodides, electrochemical determinations of kinetics in, 18: 25424
IODINE
diffusion in irradiated uranium fuel elements, 18: 26903
diffusion in sodium at 900 to 1400°F, 18: 25326 (NAA-SR-Memo-9383)
effects on radioinduced polymerization of vinyl acetate, spectra of, 18: 25507(T) (AEC-tr-6372(p.379-85))
exchange between iodine and methyl iodide, photolyzed, 18: 25597
sorption from natural waters by earth materials, Cape Thompson, Alaska, 18: 25688 (TID-20638)
IODINE ISOTOPES
exchange between organic iodides and sodium iodide, electrochemical studies of, 18: 25424
IODINE ISOTOPES I-129
Mössbauer effect in iodine compounds, nuclear and solid state studies from, 18: 26111 (NP-13990)
IODINE ISOTOPES I-131
content in milk, effects of, on radiation dose to children, 18: 25727
content of injected, in trachea of guinea pigs, effect of thyroidectomy on, 18: 25062
deposition in tumors and thyroid of rats by selective deposition of labeled fibrinogen, 18: 25068
determination in milk, using scintillating organic anion exchange resin, 18: 25259 (NYO-10405)
distribution in human ovaries, 18: 25120
lipid content of, method for determining, 18: 25296
uptake by human thyroid, 18: 25237
uptake by man, 18: 25693
use in radiodiagnosis, 18: 25257
IODINE ISOTOPES I-132
separation from tellurium-132, 18: 25039 (BLG-44)
uses in medical tracer studies, 18: 25039 (BLG-44)
ION BEAMS
interactions with plasma, 18: 26722
neutralization by electron injection, 18: 26148
ION EXCHANGE
kinetics of, on sulfocations, 18: 25422
ION EXCHANGE MATERIALS
chloride activity in Amberlite IRA-410, invasion correction function for, 18: 25297
efficiency of molecular sieve for separation of uranium from other metals, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
properties of basic lead sulfate as, 18: 25262(P)
sorptive properties of Dowex 1-X8 for europium and neodymium from bicarbonate and carbonate solutions, 18: 25438
ION EXCHANGE PROCESSES
autoclave with forced circulation for, 18: 25639 (CISE-99)
ION SOURCES
design for nanosecond pulses, 18: 26176
design of gas-discharge, 18: 25655(P)
IONIZATION CHAMBERS
construction of high-temperature, metals testing for, 18: 25776 (AEEW-M-381)
design and performance of Faraday chamber for measuring beta current density, 18: 25830(T) (AEC-tr-6372(p.35-47))
design for gas chromatography, 18: 25770(P)
design of fission, for in-pile neutron counting, 18: 25780(R) (GEAP-4600)
design of parallel-plate, effect of saturation characteristics on, 18: 25840

properties of thick-walled, for gamma radiation to 100 Mev, 18: 25847
pulse amplifier for, low-noise, 18: 25790 (NAS-NRC-Pub-1184(p.65-9))
radiation detection with, review on, 18: 25850
IONIZATION POTENTIALS
measurement of, magnetic field effects on mass-spectrometric, 18: 25345
IONOSPHERE
electric currents induced in, by magnetic field variations, 18: 26442
electron content in E-region of disturbed, spectra of low-energy, 18: 26455
electron density profiles of D layer of, rocket probe for determining, 18: 26452
hydromagnetic wave emission by, enhanced, 18: 26449
hydromagnetic wave emission by, fine structure of, 18: 26448
ion drift and recombination in F layers of, 18: 26443
layer irregularities in, magnetic activity effects on E- and F-, 18: 26441
occurrence of sporadic E, correlations for, 18: 26440
processes in D layer of, review on, 18: 26457
radio wave absorption variations in, in auroral regions, 18: 26451
radio wave propagation by, effects of nuclear explosions on, 18: 26454
whistler development in, validity of current-jet hypothesis of, 18: 26450
IONS
distributions in positive column discharge, 18: 26720
drift and loss in ionosphere, estimation of, 18: 26443
energies of plasma, in magnetic traps, 18: 26701(T) (AEC-tr-5589 (p.626-36))
energy distribution of fragment, 18: 25763
neutralization in ion engines, system for, 18: 25646
oscillations of plasma, effects of close collisions on, 18: 26737
temperature of plasma, measurement of, 18: 26708(T) (AEC-tr-5589 (p.861-8))
IOWA
nuclear power economics in, analysis, 18: 26944
IRIDIUM
activation and poisoning of thoria-coated filament emitters of, 18: 25752
alloying effects on niobium oxidation, 18: 25936
alloying effects on electric conductivity, hardness, and structure of niobium, 18: 25999
IRIDIUM ALLOYS
Ir–Mo, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Ir–Nb, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Ir–Nb, phase studies, 18: 25988
Ir–Nb–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Ir–Ta, phase studies, 18: 25988
IRIDIUM CHLORIDES
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
IRIDIUM ISOTOPES Ir-191
energy levels of, 42-kev E3 transition in, 18: 26620
IRISH SEA
radioactivity of, effect of discharge of low-activity wastes from Windscale Works to, 18: 25723
IRON
alloying effects on uranium crystal structure, 18: 25269(R) (NLCO-905)
alloying effects on fabrication of beryllium wires, 18: 25938(R) (AD-439498)
alloying effects on oxidation of plutonium–uranium alloys, 18: 26893(R) (ANL-6868(p.11-108))
analysis for sulfur by combustion, 18: 25302
corrosion of, tracer studies on early stages of, 18: 25926
determination in presence of cerium and vanadium using potassium dichromate, potentiometric, 18: 25308
determination in steel by x-ray fluorescence, 18: 25275
determination in trace amounts in uranium and uranium compounds, 18: 25272 (VDDIT-90)
diffusion in gamma uranium, 18: 25969(R) (ANL-6868(p.287-302))
diffusion of alloying metals into liquid, 18: 26010
gamma buildup factors for, 0.5- to 10-Mev, 18: 26814(T) (ORNL-tr-80)
gamma scattering at 662 kev, Rayleigh, 18: 26292
gamma scattering by, albedo for 0.66-Mev, 18: 26817
impregnation of carbon by liquid, 18: 25957(P)
magnetic hyperfine structure in iron–rhodium alloys, 18: 25982(R) (ORNL-3582(p.18-19))
melting temperature of, equations for calculating, 18: 25990
neutron elastic scattering at 0.5 to 0.8 Mev, cross sections for, 18: 26568
neutron scattering by, dose measurements in small-volume, 18: 26532 (NAA-SR-9418)
proton elastic scattering at 180 Mev, strong absorption model for, 18: 26562
proton reactions at 1 to 3 Bev, isotope production in, 18: 26583
radiation effects on content in rabbit serum, x, 18: 25164
radiation effects on electrochemical behavior, 18: 25553
reactions with uranyl sulfate to produce uranium(IV) fluoride salts, 18: 25323 (HW-48782)
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
separation of molybdenum from, by reversed-phase chromatography using hydrochloric and sulfuric acids, 18: 25280
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
thermal conductivity of sintered, 18: 25987(T) (NP-tr-1247)
thermal diffusion at 1300 to 2500°C, 18: 25986 (WADD-TR-60-581(Pt.IV))
thermal properties, 18: 26896(R) (ANL-6868(p.133-74))
IRON ALLOYS
bonding to uranium, zirconium, and their alloys, 18: 25962(P)
compatibility of Armco, with iron–uranium alloys and uranium at 740 to 1300°C, 18: 26893(R) (ANL-6868(p.11-108))
Al–Fe–U, fabrication for minimum irradiation growth, 18: 25910(P)
Al–Fe–U, radioinduced dimensional changes, 18: 25910(P)
Au–Fe, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))
Cr–Cu–Fe–Mo–Ni–Ti, corrosion and fabrication properties for use as nuclear fuel reprocessing plant dissolver, 18: 25996
Cr–Fe–Ni, corrosion of Incoloy 800 by steam, 18: 26824(R) (ANL-6885)
Cr–Fe–Ni, electron-microprobe analysis for components, 18: 25269(R) (NLCO-905)
Cu–Fe–Zr, corrosion by steam, effects of additives on, 18: 26824(R) (ANL-6885)
Fe–Mo, diffusion into liquid iron at 1923°K, 18: 26010
Fe–Nb, diffusion into liquid iron at 1923°K, 18: 26010
Fe–Pd, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Fe–Pd–rare earth, magnetic moment alignment in dilute, 18: 25977(R) (ORNL-3582(p.2-4))
Fe–Pu–U, properties as zero-power reactor fuels, 18: 26824(R) (ANL-6885)
Fe–Rh, magnetic hyperfine structure of iron in, 18: 25982(R) (ORNL-3582(p.18-19))
Fe–U, compatibility with Armco iron at 740 to 1300°C, 18: 26893(R) (ANL-6868(p.11-108))
Fe–W, diffusion into liquid iron at 1923°K, 18: 26010
Fe–Zr, anisotropic hfs interactions of, 18: 26038
IRON(III) CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
IRON COMPLEXES
with dialkyl phosphoric acids, preparation and properties, 18: 25429
IRON CYANIDES
oxidation-reduction of ferro-ferricyanide couples, graphite electrodes for, 18: 25320 (COO-1148-84)
IRON GLUCONATES
Mössbauer spectra in, 18: 25347
IRON IONS
electron paramagnetic resonance of trivalent, 18: 26625
spectrum in strontium titanate, EPR, 18: 25409
yield of, in radiolysis of ferrous sulfates, effects of oxygen in 0.8 $N H_2SO_4$ on, 18: 25590
IRON ISOTOPES Fe-56
helium-3 reactions (He-3,t) at 25 Mev, 18: 26596
neutron scattering by, optical model calculations of cross sections for, 18: 26663
neutron total cross sections of, 18: 26543(R) (ORNL-3582(p.75-82))

IRON ISOTOPES Fe-57
gamma emission by, elastic nuclear-resonant scattering of, 18: 26657
gamma emission in crystals, interference of Rayleigh and nuclear-resonant scattering in, 18: 26656
gamma scattering by, polarization effects in resonant, 18: 26535(R) (ORNL-3582(p.20-3))
IRON ISOTOPES Fe-59
intestinal absorption in man of, measured by whole-body counting and fecal recovery, 18: 25072
use in radiodiagnosis, 18: 25257
IRON(III) NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
IRON(II) OXIDES
FeO–Fe_2O_3–MgO, phase studies, 18: 26058
IRON(III) OXIDES
determination in cements by x-ray fluorescence, 18: 25275
reactions with oxides of europium and dysprosium, 18: 26896(R) (ANL-6868(p.133-74))
CaO–Cr_2O_3–Fe_2O_3, analysis by x-ray fluorescence, 18: 25275
CoO–Fe_2O_3, analysis by x-ray fluorescence, 18: 25275
FeO–Fe_2O_3–MgO, phase studies, 18: 26058
Fe_2O_3–NiO, analysis by x-ray fluorescence, 18: 25275
IRON PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
IRON(II) SULFATES
Mössbauer spectra in, 18: 25347
IRON SYSTEMS
Al–Fe–Si–U, fabrication of rods and tubes by rolling, 18: 25940 (BMI-X-294)
C–Fe, mechanical properties at high pressures and temperatures, 18: 25972 (ASD-TDR-63-90(Vol.II))
C–Fe, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
C–Fe–O, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
Cr–Fe–UC, phase studies, 18: 26058
Fe–UC, corrosion by carbon dioxide, 18: 26059
Fe–UC, mechanical properties of skull-cast, 18: 26059
IRRADIATION FACILITIES
design for chemical irradiations on large scale, 18: 25601(P)
design of large 500-curie cobalt-60, 18: 25526(T) (AEC-tr-6372(p.521-32))
design of low-temperature, for studies of neutron damage to crystals, 18: 26963(T) (KFK-tr-139)
ISOBUTYRIC ACID
α-hydroxy-, complexes with rare earths, formation constants, 18: 25260
α,β,β′-trihydroxy-, complexes with rare earths, formation constants, 18: 25260
complexes with rare earths, formation constants, 18: 25260
ISOTOPE EFFECTS
in hydrogen electrode reactions, equation for determining stoichiometric number of rate-determining step in, 18: 25400
in phase equilibria of mono- and polyatomic molecules, study of intermolecular forces from, 18: 25373
ISOTOPE SEPARATION METHODS
principles and applications of the gas centrifuge for, 18: 25878(T) (JPRS-23767(p.7-28))
ISOTOPES
preparation of radiation targets at ORNL, 18: 25877 (ORNL-3400)
use in body scanning in radiodiagnosis, 18: 25257
ISOTOPIC EXCHANGE
kinetics of iodine, electrochemical measurements of, 18: 25424

J

JAWS
radiation injuries in rats as affected by injury of, 18: 25199
JOINTS
design of releasable fluid-tight, 18: 25638(P)
JOURNAL BEARINGS
pressure distributions around spiral-grooved self-acting gas-lubricated, 18: 25640 (TID-20632)

K

KETENE
radioinduced polymerization of liquid and solid, products and reaction velocity of, 18: 25493(T) (AEC-tr-6372(p.223-35))
radioinduced polymerization of, crystal structure of polymers produced in, 18: 25501(T) (AEC-tr-6372(p.311-21))
radioinduced polymerization of solid, epitaxy in, 18: 25502(T) (AEC-tr-6372(p.323-30))
KETENE, DIMETHYL-
radioinduced polymerization of, products and reactivity of, 18: 25494(T) (AEC-tr-6372(p.237-46))
radioinduced polymerization with carbonyl compounds, products and reactivity of, 18: 25494(T) (AEC-tr-6372(p.237-46))
KETONES
formation in radioinduced telomerization of acetaldehyde with cyclohexane or hexene, 18: 25510(T) (AEC-tr-6372(p.405-12))
radioinduced polymerization with dimethylketene, products and reactivity of, 18: 25494(T) (AEC-tr-6372(p.237-46))
KIDNEYS
function tests on, use of iodine-labeled hippuran and rose bengal in, 18: 25050
radiodiagnosis of tumors in, development of scintillation camera for, 18: 25236
KRYPTON
additive effects on lifetime of metastable helium atoms, 18: 26238
bubble release and swelling in solids, model for, 18: 26080
charge transfer with protons, cross sections for Lyman alpha emission from, 18: 26235
diffusion in irradiated uranium fuel elements, 18: 26903
ionization potential, 18: 25345
melting temperature of, equations for calculating, 18: 25990
KRYPTON IONS
electron-capture cross sections at 0.4 to 3.6 kev, 18: 26229
KRYPTON ISOTOPES Kr-85
measurement of regional blood flow through dog skin using, 18: 25070

L

LABORATORIES
air circulation in, for high-level radiation studies, 18: 25718
LAMINATES
particle motion in, radiation emission in relativistic, 18: 26297
LANTHANUM
alloying effects on niobium oxidation, 18: 25936
alloying effects on electric conductivity, hardness, and structure of niobium, 18: 25999
current yield and electrolytic properties in ethanol–neodymium chloride solutions on mercury cathode, 18: 25620
determination in high-purity compounds, spectrographic, 18: 25288
effects on polarographic reduction of hydrogen peroxide in solution, 18: 25443
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
ion exchange behavior in organic solvents containing organic acids, 18: 25305
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26[illegible]
precipitation using adipic, malonic, phthalic, and succinic acids, 18: 25351
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
separation from nonaqueous solutions by solvent extraction using ethanol and neodymium chloride on mercury cathode, 18: 25620
separation from scandium by cation exchange chromatography, 18: 2561[illegible]
solvent distribution in perchloric acid–TBP systems, 18: 25381
solvent extraction from nitric acid solutions by TBP, calculated cascade equilibria for, 18: 25624
sorption by ion exchange resins from nitric acid–2-propanol–water solutions, 18: 25395

LANTHANUM ALLOYS
Cl–La, heat of formation of stoichiometric, 18: 26824(R) (ANL-6885)
LANTHANUM ALUMINATES
iron EPR in, 18: 26625
LANTHANUM AZIDES
thermal decomposition of, differential thermal analysis of, 18: 25446
LANTHANUM CHLORIDES
complexes with 1,10-phenanthroline, structure and thermal stability of, 18: 25387
LANTHANUM COMPLEXES
with acetyl-, benzoyl-, and propionylacetonates, stability of, 18: 25389
with dialkyl phosphoric acids, preparation and properties, 18: 25429
LANTHANUM FERRATES
$BiFeO_3$–$LiFeO_2$, atomic displacements and magnetic ordering in crystals of, 18: 25418(T)
LANTHANUM ISOTOPES La-139
neutron reactions (n,α) at 14.1 Mev, alpha energy spectrum for, 18: 26606
nuclear magnetic resonance, quadrupole, 18: 26625
LANTHANUM ISOTOPES La-140
beta decay of, $3^-(\beta)2^+$ transitions in, 18: 26607
decay, beta-gamma directional correlation coefficients of, 18: 26683
LANTHANUM NIOBATES
fluorescence spectra, 18: 26017
$CaWO_4$–$LaNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
LANTHANUM NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
$La(NO_3)_3$–HNO_3–H_2O–$Y(NO_3)_3$, phase studies, 18: 25434
LANTHANUM PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
thermal decomposition of, differential thermal analysis and thermogravimetric studies on, 18: 25396
LANTHANUM PHOSPHATES
preparation and single crystal growth of ortho-, 18: 25356
LANTHANUM SILICATES
preparation of, by reaction of lanthanum sulfates with sodium silicate, 18: 25433
LANTHANUM SULFATES
reaction with sodium silicates, preparation of lanthanum silicates by, 18: 25433
reduction of anhydrous, by carbon monoxide, 18: 25427
LANTHANUM TANTALATES
fluorescence spectra, 18: 26017
LANTHANUM TELLURIDES
phase studies and properties, 18: 25430
LARYNX
radiotherapy of squamous-cell carcinoma of, dose-time relation, 18: 25250
LEAD
beta absorption, effects of atomic weight on, 18: 26812(T) (AEC-tr-6372(p.11-15))
charged particle reactions with, astatine isotope production in, 18: 26602
content in solar atmosphere, 18: 26202
current fluctuations in superconducting, 18: 26484
determination in ratio with uranium in allanite from Baekura District, India, x-ray fluorescence, 18: 25704
electron backscattering at 8 to 22 Mev, 18: 26216
energy gap of superconducting films of, 18: 26488
gamma buildup factors for, 0.5- to 10-Mev, 18: 26814(T) (ORNL-tr-80)
gamma elastic scattering by, polarization in, 18: 26293
gamma scattering at 662 kev, Rayleigh, 18: 26292
gamma scattering by, albedo for 0.66-Mev, 18: 26817
helium-3 elastic scattering at 20 Mev, differential cross sections, 18: 26681
ion exchange behavior in organic solvents containing organic acids, 18: 25305
ion exchange in nitric acid–2-propanol–water solvents, complexing in, 18: 25384
melting temperature of, equations for calculating, 18: 25990
neutron elastic scattering at 0.5 to 0.8 Mev, cross sections for, 18: 26568
neutron elastic scattering by RPb at 5.0 Mev, angular distributions, 18: 26671
neutron inelastic scattering by RPb at 4.0 to 6.5 Mev, energy spectra, 18: 26671
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
superconductivity above critical field in, surface, 18: 26480
use in superconducting d-c generator, 18: 26465
LEAD ALLOYS
In–Pb, surface impedance in superconducting, 18: 26489
Pb–Tl, surface superconductivity above critical field in, 18: 26480
LEAD COMPLEXES
with dialkyl phosphoric acids, preparation and properties, 18: 25429
LEAD GLASS
radiation leakage through, in fluoroscopic screen assemblies, 18: 25249
LEAD IONS
effects on alkali-halide radiation stability, 18: 25585(T)
LEAD IRON TUNGSTATES
crystal structure of, atomic displacements and magnetic ordering in, 18: 25418(T)
LEAD ISOTOPES Pb-206
alpha reactions (α,n) and (α,2n) with, polonium-210 production in, 18: 26647
electric dipole transitions in, nuclear structure effects on internal pair formation for, 18: 26581
neutron separation energy for, 18: 26576
neutron total cross sections of, 18: 26543(R) (ORNL-3582(p.75-82))
LEAD ISOTOPES Pb-207
energy levels of, decay of $f_{5/2}$, 18: 26603
neutron separation energy for, 18: 26576
neutron total cross sections of, 18: 26543(R) (ORNL-3582(p.75-82))
LEAD ISOTOPES Pb-208
neutron scattering by, phase shifts from, 18: 26545(R) (ORNL-3582(p.86-90))
neutron separation energy for, 18: 26576
neutron total cross sections of, 18: 26543(R) (ORNL-3582(p.75-82))
LEAD ISOTOPES Pb-210
use in Antarctic snow age determination, 18: 25702
LEAD ISOTOPES Pb-213
isolation from radon-221 and half life of, 18: 25869
LEAD NITRATE COMPLEXES
in nitric acid–2-propanol–water ion exchange systems, 18: 25384
LEAD NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
LEAD PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
LEAD SULFATES
ion exchange properties of basic, 18: 25262(P)
LEAK DETECTORS
design of MC 10 analysis cell, 18: 25761
LEAVES
radiation effects of seed irradiation on size of nuclei of assimilatory tissues in, 18: 25136
radioinduced tumors of, in barley, 18: 25178
strontium content of, in India, 18: 25067
LEPTONS
emission in strongly interacting particle decay, 18: 26272 (BNL-837 (p.299-302))
interactions with baryons and charged vector mesons, field theory for, 18: 26267 (BNL-837(p.237-48))
LEUKEMIA
classification of, by drug sensitivity, 18: 25049
occurrence in Hiroshima and Nagasaki populations exposed to atomic bomb, 18: 25728
radioinduced during pregnancy, 18: 25152
radioinduced, in man, 18: 25241

radioinduced, in man, 18: 25193
radioinduced, in mice, effects of ACTH on, 18: 25226
LEUKOCYTES
radiation effects on segment index of, in guinea pigs, 18: 25203
radiation effects on production of, in starch-injected and normal parabiotic rabbits, 18: 25150
radiation effects on chromosomes of, following radiotherapy of ankylosing spondylitis, 18: 25158
radiation effects on chromosomes in, in man, 18: 25163
LIBRARIES
data listing program for U.K.A.E.A. nuclear data library, 18: 25879 (AWRE-O-4/64)
LIFE SPANS
radiation effects on dog, statistical analysis of, 18: 25094(R) (UCD-472-109(p.173-7))
LIGHT
emission by lithium fluoride crystals upon cracking, 18: 25419(T)
scattering by light, in double-dispersion representation, 18: 26318
scattering by light in plasma, quantum-mechanical cross section for, 18: 26692 (NP-14011)
LINEAR ACCELERATORS
construction of complete plant for 240-Mev-electron, 18: 26173
waveguide for electron, 18: 26183(P)
LINOLEIC ACID
metabolism in liver fat in chicks, carbon-14 and tritium studies of, 18: 25077
synthesis of tritium-labeled, 18: 25077
LIPIDS
effects of injected, on reticuloendothelial activity in mice, 18: 25217
iodine-131 content of, method for determining, 18: 25296
metabolism in pigeons, 18: 25087(R) (TID-20641)
protective effects of injected, against radiation injuries in mice, 18: 25217
LIQUID FLOW
heat transfer in, oscillatory behavior below critical point, 18: 26824(R) (ANL-6885)
in stationary porous pipe, spiral, 18: 25669
LIQUID METAL COOLED REACTORS
fission product release by sodium at 900 to 1400°F, out-of-pile evaluation, 18: 25326 (NAA-SR-Memo-9383)
use in lunar power station, 18: 26956 (MTP-ASTR-A-63-8)
use of mercury–steam binary power cycle in, 18: 26949
LIQUIDS
compressibilities and heat capacities of, calculation of, 18: 25367
diffusion-controlled processes in, 18: 25562
radioinduced ion pair formation in, 18: 25555
structure of, neutron scattering study of microdynamics of, 18: 26507
zero sound in superfluid Fermi, absence of, 18: 26471
LITHIUM
content in solar atmosphere, 18: 26202
electron energy levels, P-2 fine structure of, 18: 26231
melting temperature of, equations for calculating, 18: 25990
nuclear hyperfine structure of, in lithium fluoride crystals, 18: 25414
proton elastic scattering at 180 Mev, strong absorption model for, 18: 26562
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
use of liquid, for precipitation of thorium from magnesium–thorium alloys, 18: 25904
LITHIUM BORATES
preparation and properties, 18: 25331(T) (AWRE-Trans-43)
LITHIUM BROMIDES
LiBr–TBP, solvent properties for cobalt, copper, manganese, nickel, and zinc, 18: 25382
LITHIUM, BUTYL-
dielectric properties of, effects of ether and triethylamine on, 18: 25452
LITHIUM CHLORIDES
effects on metal ion adsorption on anion exchange papers, 18: 25374
ion exchange on resins in, invasion correction function for, 18: 25297
oxidation to perchlorate, equipment and method for anodic, 18: 25386
polarography of dysprosium in aqueous solutions of, 18: 25333
thermodynamic properties of, 18: 25360
LiCl–KCl, electric conductivity of molten, 18: 26019
LiCl–KCl–UCl_3, purification of uranium by electrorefining of, 18: 25399
LiCl–KCl, thermodynamic properties of uranium tetrachloride in fused solutions, 18: 25340
LITHIUM COMPOUNDS
uses of vapors of, to protect metals against oxidation, 18: 25933
LITHIUM FLUORIDES
crystal structure of, effects of self-trapped holes on, 18: 25414
fluorescence of crystals of, data tables for x-ray, 18: 25330 (Y-1470-C)
radiation effects on dislocation distribution and microhardness of, 18: 26082
spectra in, optical absorption, 18: 25408
spectra of isotopically enriched, optical absorption F-band, 18: 25410
thermodynamic properties of, 18: 25360
triboluminescence in crystals of, 18: 25419(T)
LITHIUM GADOLINATES
magnetic properties and structure of, 18: 25397
LITHIUM ISOTOPES Li-6
deuteron reactions (d,α), (d,d), (d,p), 25-Mev beryllium-8 level from, 18: 26617
proton reactions (p,2p) at 185 Mev, 18: 26567
proton reactions (p,n) to 14 Mev, neutron yield in, 18: 26601
proton reactions (p,pd) with, wave functions for, 18: 26643
spectra in lithium fluoride, optical absorption F-band, 18: 25410
LITHIUM ISOTOPES Li-7
deuteron reactions (d,2nn) with, distributions from, 18: 26548(R) (ORNL-3582(p.99))
nuclear magnetic resonance of, chemical shifting by paramagnetic ions, 18: 25425
proton reactions (p,2p) at 185 Mev, 18: 26567
proton reactions (p,n) at 4 to 14 Mev, neutron yield in, 18: 26601
proton reactions (p,pd) with, wave functions for, 18: 26643
spectra in lithium fluoride, optical absorption F-band, 18: 25410
LITHIUM ISOTOPES Li-8
distributions in meson (K^-) reactions with nuclei at 1.5 Bev/c, 18: 26636
LITHIUM NITRATES
electric conductivity of molten, direct current measurement of, 18: 26018
$LiNO_3$–KNO_3, electric conductivity of molten, 18: 26018
$LiNO_3$–KNO_3–$NaNO_3$, electric conductivity at 134 to 384°C, 18: 26020
$LiNO_3$–$NaNO_3$, electric conductivity of molten, 18: 26018
LITHIUM OXIDES
B_2O_3–Li_2O, radiation effects on ESR spectra of, 18: 26079
LITHIUM RARE EARTH FLUORIDES
preparation, 18: 25318 (CONF-405-39)
LITHIUM RARE EARTH OXIDES
preparation, 18: 25318 (CONF-405-39)
LITHIUM URANATES
spectra and structure, 18: 25388
LITTER SIZES
radiation effects on, in guinea pigs, 18: 25230
LIVER
deposition of iodine-131-labeled fibrinogen in, in rats, 18: 25068
distribution of phosphorus-32-labeled colloid in, in rabbits, 18: 25075
effects of thorium dioxide injection on ultrastructure of, in fish and lizards, 18: 25066
function tests on, use of iodine-labeled hippuran and rose bengal in, 18: 25050
metabolism of linoleic acid in fat of, in chicks, carbon-14 and tritium studies of, 18: 25077
radiation effects on bacterial agglutination by polypeptides of rabbit, x, 18: 25110
radiation effects on regeneration of mouse, brief and prolonged, 18: 25122
radiation effects on cytochemical changes in, 18: 25141
radiation effects on enzyme activity in rat, 18: 25154
radiation effects on development of tumor metastases in, of mice, 18: 25162
radiodiagnosis of tumors in, development of scintillation camera for, 18: 25236
radioinduced tumors of human, Thorotrast, 18: 25205
synergistic effects of radiation and halothane anesthesia on, pathological,

18: 25118
LIVER DISEASES
radioinduced by uterine carcinoma therapy, effects of halothane on, radium and x, 18: 25119
LUMINESCENT DETECTORS
radiophotoluminescence in metaphosphate glass microdosimeters in dark storage, stability of, 18: 26076
LUNGS
fallout in deer, 18: 25693
neodymium oxide distribution in, after inhalation, 18: 25078
LUTETIUM
determination using Xylenol Orange, spectrophotometric, 18: 25285
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
LUTETIUM ISOTOPES Lu-175
transition spectra in, Alaga's rules for electromagnetic, 18: 26628
LUTETIUM NIOBATES
$CaWO_4$–$LuNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
LUTETIUM NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
LUTETIUM TANTALATES
fluorescence spectra, 18: 26017
LYMPH
bilirubin content of, effects of Thorotrast on, in dogs, 18: 25060
LYMPH CELLS
radiation effects on DNA content of, in spleen of rats, 18: 25137
LYMPH DISEASES
radiotherapy of Hodgkin's disease, time-dose relations for, 18: 25251
LYMPH SYSTEM
radiation effects on desoxyribonucleic acid content and morphology of nodes in guinea pigs, 18: 25102
LYXOSE
oxidation by sodium chlorite tritium kinetic isotope effects in, 18: 25459

M

MAGNESIUM
deposition of films of, on uranium metal, 18: 25911(P)
dissolution of irradiated, equipment and methods for, 18: 25610 (SGAE-CH-4/1964)
dissolution of, media for, 18: 26903
grain-boundary cavities in, effects of substructure on nucleation of, 18: 26021
ignition in flame, 18: 25328(R) (SC-DC-64-864)
melting temperature of, equations for calculating, 18: 25990
neutron scattering cross sections at 0.5 to 0.8 Mev, 18: 26571
production by fusion electrolysis, 18: 25913(P)
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
MAGNESIUM ALLOYS
Al–Cu–Mg–Zn, corrosion resistance of, effects of age hardening, chromium, and silver on stress, 18: 25946(T) (RSIC-177)
Al–Mg, reactions of 6061 alloy with steam, 18: 26824(R) (ANL-6885)
Al–Mg–Mn, creep properties at high temperatures, 18: 26066(P)
Mg–Ag, self-diffusion of silver-110 in, 18: 26051
Mg–Th, separation of thorium from, using liquid lithium, 18: 25904
Mg–Zr, grain-boundary cracking and mode of creep failure in, 18: 26032
MAGNESIUM CARBIDES
preparation, 18: 26824(R) (ANL-6885)
MAGNESIUM CHLORIDES
thermodynamic properties of, 18: 25360
MAGNESIUM COMPLEXES
with substituted 2-(pyridyl) and 2-(quinolyl)-1,3-indanediones, acid dissociation and formation constants of, 18: 25457
MAGNESIUM FLUORIDES
thermodynamic properties of, 18: 25360
MAGNESIUM ISOTOPES Mg-24
alpha elastic and inelastic scattering by, at 18 to 21.4 Mev, 18: 26550(R) (ORNL-3582(p.101-2))
neutron elastic and inelastic scattering at 14.1 Mev, 18: 26600
neutron reactions (n,γ) with, spectra from resonant, 18: 26542(R) (ORNL-3582(p.71-5))
proton reactions (p,2p) at 185 Mev, 18: 26567
MAGNESIUM ISOTOPES Mg-25
deuteron elastic scattering at 10 Mev, angular distributions for, 18: 26561
MAGNESIUM ISOTOPES Mg-26
helium-3 reactions (He-3,t) at 25 Mev, 18: 26596
MAGNESIUM OXIDES
lattice parameters and thermal expansion of, x-ray diffraction study of, 18: 26109 (LA-2687)
radiation effects on crystalline, deuteron and fission-fragment, 18: 25893(R) (ANL-6868(p.355-72))
FeO–Fe_2O_3–MgO, phase studies, 18: 26058
MgO–Y_2O_3, thermal expansion to above 2000°C, 18: 25355
MAGNESIUM SULFATES
corrosive effects on A238 aluminum alloy, 18: 25920(R) (ANL-6868 (p.338-54))
MAGNESIUM URANATES
reduction to uranium, 18: 25618
MAGNET COILS
analysis of mirror, for producing imploding spherical shock wave, 18: 26151
energy storage in, superconducting power switches for, 18: 26493
MAGNETIC FIELDS
charged particle movement in, energy dissipation in, 18: 26128
charged particle motion in, equations for nonrelativistic, 18: 26147
charged-particle motion in dipole, glow discharge experiments on area of, 18: 26117(T) (JPRS-23767(p.57-61))
distribution in plasma waveguides, 18: 26778
distribution in rotating plasma at thermodynamic equilibrium, 18: 26717
electromagnetic wave interactions with ionizing shock waves in d-c, 18: 26125
electromagnetic wave propagation in plasma in strong, 18: 26784
fluid flow in, theory of channel, 18: 26718
magnetohydrodynamic flow past rigid bodies in aligned, 18: 26126
measurement of terrestrial, using nuclear-resonance filter, 18: 26458
modulation combined with frequency in electron paramagnetic resonance spectrograph, 18: 25762
plasma acceleration by gradients of, 18: 26742
plasma confinement in, at high pressures, 18: 26762
plasma containment in, theory of, 18: 26718
plasma containment in cusped geometry, 18: 26783
plasma diffusion in, 18: 26768
plasma diffusion in, 18: 26772
plasma electrostatic instability in, 18: 26732
plasma flow across azimuthal, 18: 26773
plasma flow in electric and, stress tensor for, 18: 26734
plasma interactions with d-c, 18: 26775
plasma motion in cusped, 18: 26741
plasma oscillations in, 18: 26777
plasma stability in, heterogeneous, 18: 26767
plasma wave propagation in, collision-free, 18: 26746
plasmoids in, theory of force-free, 18: 26751
shock propagation in gases in, evolution of trans-Alfvenic, 18: 26122
shock wave attenuation in ionized gas in transverse, 18: 26802
shock wave propagation in plasma in transverse, analysis of, 18: 26752
sound absorption in liquid metals in d-c, measurement of, 18: 26131
MAGNETIC MIRRORS
charged particle escape from plasma in magnetic bottle, 18: 26799
charged-particle motion in, 18: 26702(T) (AEC-tr-5589(p.637-77))
plasma confinement in, at high pressures, 18: 26762
plasma ion energies in, 18: 26701(T) (AEC-tr-5589(p.626-36))
plasma stability in, 18: 26695(T) (AEC-tr-5589(p.83-96))
plasma stability in, 18: 26744
MAGNETIC PROBES
diagnostic use in azimuthal pinch discharges, 18: 26735
MAGNETIC PROPERTIES
book: *High-Temperature Materials*. No. 2, *Properties Index*, 18: 26064(T)
MAGNETIC RECORDING SYSTEMS

description of Harwell tape, 18: 25747 (NAS-NRC-Pub-1184(p.296-304))
description of Micro Tape and magnetic drum, 18: 25881 (NAS-NRC-Pub-1184(p.266-8))
MAGNETIC RESONANCE
quantum transitions in large-angular-momentum molecular, 18: 26422
MAGNETIC SUSCEPTIBILITY
measurement in intermetallic compounds and solid solutions, 18: 26522(R) (ANL-6868(p.326-30))
MAGNETITE CONCRETES
gamma buildup factors for, 0.5- to 10-Mev, 18: 26814(T) (ORNL-tr-80)
MAGNETOHYDRODYNAMIC CELLS
conference, 18: 26257
development, 18: 26824(R) (ANL-6885)
efficiency of gas and steam cycles for nuclear, 18: 26258
plasma transport in, 18: 26771
properties, 18: 26255
segmented electrode losses in, with nonequilibrium ionization, 18: 26252 (BSD-TDR-64-35)
MAGNETOHYDRODYNAMICS
book: *Problems of Magnetogasdynamics. Part I*, 18: 26807
boundary layer friction and heat exchange in, 18: 26787
channel flow, propagation of small amplitude waves in steady, 18: 26805
flow of electrically conducting fluid along channel in magnetic field, 18: 26140
fluid flow past rigid bodies in aligned fields, analysis of, 18: 26126
fluid flow up vertical plate in, analysis of, 18: 26124
plasma equilibria at high pressures, 18: 26762
plasma penetration into vacuum in magnetic field, 18: 26711(T) (FTD-TT-64-400)
shock wave attenuation in ionized gas in transverse magnetic field, 18: 26802
shock wave structure in, effects of electron inertia on, 18: 26149
shock waves in fully ionized perfect gas, properties of plane perpendicular, 18: 26693 (RISO-76)
theory for channel flow and magnetic containment, 18: 26718
wave growth and stability in slightly ionized plasma in magnetic field, 18: 26689 (BSD-TDR-64-34)
MAGNETOSPHERE
sudden impulses in, observations on, 18: 26447
MAGNETS
design and construction of 100 kgauss d-c, 18: 26167 (CERN-64-23)
design for accelerator beam deflection, 18: 26185(P)
electro-, field-controlled power supply for, 18: 25642
superconductors for, 18: 26478
MAGNOX ALLOYS
properties of A12 and ZA for use as canning materials, comparison of, 18: 26025
MALAYA
fallout monitoring, 1961 and 1962, 18: 25698
MALEIC ACID
additive effects on radioinduced graft polymerization of polypropene to acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, 18: 25505(T) (AEC-tr-6372(p.363-9))
radioinduced crosslinking in resin with phytic acid and propylene glycol, hardening in, 18: 25527(T) (AEC-tr-6372(p.533-8))
MALEIC ACID, DIETHYL ESTER
radioinduced polymerization of *cis-* and *trans-*, 18: 25491(T) (AEC-tr-6372(p.207-12))
MALEIC ANHYDRIDE
radioinduced polymerization of *cis-* and *trans-*, 18: 25491(T) (AEC-tr-6372(p.207-12))
MALONIC ACID
precipitation of cerium and lanthanum using, 18: 25351
MAMMALS
fallout in lungs of deer, 18: 25693
MAN
cesium-137 content of, in southern Finland, 1961 to 1964, 18: 25687 (NP-13981)
cesium-137 content in Finnish Lappa, 1964, 18: 25710 (NP-13984)
diagnosis of chronic radiation sickness in, 18: 25153
effects of stress on monoamine dioxidase activity in blood, 18: 25086(R) (TID-20636)
fallout uptake by, 18: 25693
iodine-131 distribution in ovaries of, 18: 25120
measurement of intestinal absorption of iron-59 in, comparison of whole-body counting and fecal recovery methods, 18: 25072
pathological effects of injected Thorotrast in, delayed, 18: 25147
radiation effects on adrenal activity in, 18: 25104
radiation effects on skin of, 18: 25080 (AHSB(RP)R-39(p.11-19))
radiation effects on, 18: 25144
radiation effects on, physical aspects of, 18: 25145
radiation effects on blood picture in, 18: 25174
radioactivity of Arctic, effects of fallout fission products on, 18: 25685 (NP-13985)
radioinduced cataracts in, effect of dose fractionation on, 18: 25200
radioinduced liver tumors in, Thorotrast, 18: 25205
radiotherapy of malignant tumors in, using gamma unit, 18: 25254
space flight medical problems in, 18: 25045
therapeutic effects of semicarbazide-cadmium on malignant tumors in, 18: 25054
MANDELIC ACID, *p*-BROMO-
use in separation of uranium from zirconium alloys, 18: 25283
MANGANESE
determination in trace amounts in uranium and uranium compounds, 18: 25272 (VDDIT-90)
diffusion in gamma uranium, 18: 25969(R) (ANL-6868(p.287-302))
melting temperature of, equations for calculating, 18: 25990
neutron activation of, absolute measurement of efficiency of neutron sources by, 18: 26504
preparation of pure, 18: 25912(P)
protective effects against nucleic acid decomposition by nuclease, 18: 25085 (SGAE-BL-5/1964)
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
solvent partition in aqueous bromide–TBP systems, 18: 25382
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
MANGANESE ALLOYS
Al–Mg–Mn, creep properties at high temperatures, 18: 26066(P)
Cr–Mn, crystal structure of dilute, 18: 25979(R) (ORNL-3582(p.7-8))
Mn–Pd, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868(p.303-25))
Mn–Pt, crystal and magnetic structure of $PtMn_3$, 18: 25971(R) (ANL-6868(p.331-7))
Mn–V, crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
MANGANESE CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
MANGANESE COMPLEXES
with substituted 2-(pyridyl) and 2-(quinolyl)-1,3-indanediones, acid dissociation and formation constants of, 18: 25457
MANGANESE IONS
spectra in rutile, ESR, 18: 25411
MANGANESE ISOTOPES Mn-52
production by proton reactions in thick iron targets, cross sections for, 18: 26583
MANGANESE ISOTOPES Mn-54
content in Sputnik 4 fragment, 18: 26127
production by proton reactions in thick iron targets, cross sections for, 18: 26583
MANGANESE ISOTOPES Mn-55
nuclear magnetic resonance in cesium manganese fluoride, 18: 26159
MANGANESE NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
MANGANESE OXIDES
thermodynamics of nonsubstitutional solid solutions of, statistical model for, 18: 25421
MANGANESE PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
MANGANESE ZINC FERRATES

magnetic properties, 18: 26058
MANNOSE
oxidation by sodium chlorite tritium kinetic isotope effects in, 18: 25459
MARITIME REACTORS
fuel element mounting device for pressurized-water, 18: 26961(P)
shielding of, testing of secondary, 18: 26958 (NP-12562)
MASERS
conference, 18: 26435
MASERS (OPTICAL)
conference, 18: 26435
development of rotating-prism, 18: 26992
energy transfer in crystalline, 18: 26119
interference of light from two, quantum theory of, 18: 26425
spectra in rare-gas, emission, 18: 26114(R) (ORNL-3582(p.36-7))
MASS SPECTROMETERS
cleaning sample valves in, systems for, 18: 25269(R) (NLCO-905)
design of selecting, with high resolving power, 18: 25772(P)
measurement of ionization potentials using, magnetic field effect in, 18: 25345
review of Harwell, 18: 25740 (EANDC(UK)-25L)
use for measuring kinetic energy of fragment ions, 18: 25763
MATERIALS TESTING
betatron for nondestructive, portable, 18: 25677
electromagnetic inspection of thin-walled tubing, pulsed system for, 18: 25674 (ANL-6728)
nondestructive electromagnetic and magnetic methods of, for reactor components, 18: 25678
nondestructive methods for, 18: 25675(R) (ANL-6868(p.219-28))
nondestructive methods for fast reactor fuel elements, 18: 26893(R) (ANL-6868(p.11-108))
radioisotope uses in, 18: 26992
vibration method for measuring elastic constants of small plates, 18: 25679
MATERIALS TESTING REACTOR
fuel element testing in, 18: 26893(R) (ANL-6868(p.11-108))
MATHEMATICS
Bernstein-polynomial approximation of two-variable functions, 18: 25887
Fourier integrals in, asymptotic expansion of, 18: 26280
Green's functions for external fields, 18: 26386 (NP-13958)
group theory in quantum mechanics, 18: 26438
MATTER
many-body theory of, Moszkowski and Scott approximation of Brueckner's, 18: 26369
MECHANICS
book: *Electrodynamics of Plasmas Based on Statistical Mechanics, Vol. I, Physical Processes and Mathematical Methods*, 18: 26793
energy state and occupation number fluctuations in, 18: 26411
equilibrium system, fluctuation-dissipation theorem in classical nonstationary, 18: 26724
MEDICINE
aerospace, problems in, 18: 25044
applications of radiation in, 18: 25246
fallout problems for, 18: 25730
fluoroscopy techniques in dental, development of promethium-147 gamma source for use in, 18: 25234 (SGAE-IB/IA-2/1964)
military planning for, after nuclear attack, 18: 25729
procedures for pathologic psychologic reactions to disaster, 18: 25731
space flight, 18: 25045
MEMBRANES
radiation effects on biological, ionizing, 18: 25106
MEMORY DEVICES
performance of storage tubes for pulse amplitudes, limiting factors in, 18: 25746 (NAS-NRC-Pub-1184(p.292-5))
storage systems for, development of superconducting thin-film, 18: 26477
storage systems for, development of superconducting cable, 18: 26490
use of storage tubes for display in multiparameter pulse experiments, 18: 25826 (NAS-NRC-Pub-1184(p.322-3))
MERCHANT VESSELS
hull model studies on nuclear-powered submarine tanker, 18: 26959 (RTI/1NG(63)-4)
MERCURY
biological effects of exposure to vapor of, in pigeons, 18: 25057 (UR-645)
corrosive effects on titanium, effects of nickel inhibitors on, 18: 25919(R) (ANL-6868(p.190-200))
determination in rocks, activation, 18: 25307
deuteron scattering by, cross sections for, 18: 26560
electron scattering by, 18: 26236
flow of, radiometric measurement of void fraction in cavitating, 18: 25663
gamma scattering at 662 kev, Rayleigh, 18: 26292
neutron elastic scattering at 0.5 to 0.8 Mev, cross sections for, 18: 26568
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26671
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
MERCURY CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
MERCURY ISOTOPES Hg-199
energy level crossings, 18: 26676
neutron separation energy for, 18: 26576
MERCURY ISOTOPES Hg-200
neutron separation energy for, 18: 26576
MERCURY ISOTOPES Hg-201
energy level crossings, 18: 26676
neutron separation energy for, 18: 26576
MERCURY ISOTOPES Hg-202
neutron separation energy for, 18: 26576
MERCURY ISOTOPES Hg-204
neutron separation energy for, 18: 26576
MERCURY NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
$Hg(NO_3)_2$–HNO_3, solvent properties for aluminum–uranium alloys, 18: 25269(R) (NLCO-905)
MERCURY PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
MESIC ATOMS
bound states in μH, 18: 26271 (BNL-837(p.277-91))
capture wave functions in mu-mesic hydrogen molecular ions, 18: 26555(R) (ORNL-3582(p.130))
MESON DECAY
electron spectrum, statistical calculation of, 18: 26384
MESONS
exchange in photoproduction of mesons, 18: 26373
exchange of vector, in meson (K) interactions, 18: 26342
field theory for weak-vector, interactions in, 18: 26329
interactions of pseudoscalar and vector, self-consistent model for strong, 18: 26344
interactions of vector, symmetry induction in strong, 18: 26327
interactions with leptons and mesons, field theory for, 18: 26267 (BNL-837(p.237-48))
interactions with baryons, bootstrap calculations for resonances in, 18: 26332
interactions with baryons, baryon-exchange model for inelastic, 18: 26351
mass of weak-vector, 18: 26329
models for, basic Su(3) triplets with integral charge in, 18: 26324
symmetries of, W_λ, 18: 26350
theory of intermediate-vector, in interactions with mass breaking asymmetry, 18: 26335
MESONS (K)
interactions ($K\bar{K}$) of, meson (ϕ) interpretation in, 18: 26320
interactions with mesons ($\bar{K}$), vector meson exchange in, 18: 26342
mass difference between K-1 and K-2, 18: 26263 (BNL-837(p.74-81))
production in meson (π)-nucleon interactions, models for, 18: 26281
MESONS (K^-)
interactions with emulsion nuclei at 3 Bev/c, hyperfragment production in, 18: 26290
interactions with deuterons and protons at 1.49 to 1.70 Bev/c, Y_1^* resonances in, 18: 26328
interactions with protons at 1.8 Bev/c, charge exchange in, 18: 26339
interactions with protons, Y_1^* parity and spin from, 18: 26340

interactions with polarized protons, hyperon (Ξ^-) parity and spin from, 18: 26343
production in proton reactions with beryllium at 25 Bev, 18: 26165 (BNL-837(p.91-113))
reactions with helium-4, $_{\Lambda}H^4$ lifetime from, 18: 26527 (BNL-837(p.454-6))
reactions with nuclei, nuclear trapping of hyperons (Λ) from, 18: 26623
reactions with nuclei at 1.5 Bev/c, lithium-8 fragments in, 18: 26636
scattering by helium, resonance effect in, 18: 26277(R) (ORNL-3582 (p.127-8))

MESONS (K^0)
decay of, $\Delta S = \Delta Q$ conservation in electronic, 18: 26262 (BNL-837(p.54-65))
interactions with hyperons (Λ), resonance effects in, 18: 26352
lifetime of K_2^0, 18: 26261 (BNL-837(p.42-52))
regeneration of K-1, in hydrogen, 18: 26264 (BNL-837(p.82-7))
transition (K_1^0-K_2^0) in coulomb field, form factor for, 18: 26319

MESONS (K^+)
decay of, $\Delta T = \frac{1}{2}$ nonleptonic, 18: 26349
interactions with protons near $^3/_2$-$^5/_2$ resonance, effective cross sections for, 18: 26288
interactions with protons, isobar production in, 18: 26358
interactions with protons at 910 Mev/c, production of ($K^0 + p + \pi^+$) by, 18: 26381
leptonic decay of, 18: 26349
production in proton reactions with beryllium at 25 Bev, 18: 26165 (BNL-837(p.91-113))

MESONS ($K_{\pi 3}$)
Regge poles of, effects in photoproduction of mesons, 18: 26372

MESONS (μ)
decay of, lepton charge in, 18: 26309
detection and measurement, 18: 25831
interactions with nucleons, meson (π) production by virtual photons in, 18: 26305
mass of, theory for, 18: 26335
pair production of, cross section for, 18: 26564
production of heavy, in neutrino interactions, 18: 26266 (BNL-837 (p.160-9))
scattering by nuclei, cross section for, 18: 26564
shielding for, 18: 26165 (BNL-837(p.91-113))

MESONS (μ^-)
capture by nuclei, coupling constants in, 18: 26523 (BNL-837(p.292-7))
capture rate in ($p\mu p$), 18: 26345
interactions with protons in calcium-40, induced pseudoscalar coupling constant from, 18: 26525 (BNL-837(p.315-23))
interactions with protons in hydrogen molecular ions, 18: 26555(R) (ORNL-3582(p.130))
interactions with protons, 18: 26271 (BNL-837(p.277-91))
reactions with helium-4, branching ratio in decay and, 18: 26524 (BNL-837(p.309-13))

MESONS (μ^+)
decay of, ($e + \gamma$), 18: 26356

MESONS (ω)
mass and width of, 18: 26341
photoproduction on nucleons, cross sections and meson exchange in, 18: 26373
Regge poles of, effects in photoproduction of mesons, 18: 26372
unitary spin of, 18: 26323

MESONS (ϕ)
classification of, as isoscalar member of vector meson octet, 18: 26320
production in meson (K) interactions, vector meson exchange in, 18: 26342

MESONS (π)
angular distributions in antiproton-proton interactions, 18: 26286
exchange currents in deuteron photodisintegration, dispersion theory, 18: 26375
interactions at low energies, theory of elastic, 18: 26333
interactions of, strip approximation for, 18: 26331
interactions with nucleons, production processes in, 18: 26281
interactions with nucleons, models for elastic, 18: 26281
interactions with mesons (π), amplitudes for s- and p-wave, 18: 26299
interactions with nucleons at low energies, equations for, 18: 26299
interactions with mesons (π) in 3π formation, 18: 26300
interactions with mesons (π), complex angular momentum scattering amplitudes for, 18: 26326
interactions with hyperons (Σ), resonance, 18: 26328
interactions with mesons (ρ), meson (ω) production in, 18: 26341
interactions with mesons (ρ), enhancement at 1 to 1.4 Bev, 18: 26346
interactions with nucleons, mesons (ρ) in, 18: 26348
interactions with nucleons, resonance effects in, 18: 26352
photoproduction from nucleons at high energy, Regge poles in, 18: 26385
photoproduction on nucleons by linearly polarized photons, 18: 26276 (DESY-64/6)
photoproduction on nucleons, 18: 26372
production by neutron-proton collisions at 1.6 Bev/c, 18: 26376
production by virtual photons in meson (μ)-nucleon interactions, 18: 26305
production in electron-proton interactions, 18: 26312
production in proton reactions with beryllium at 25 Bev, 18: 26165 (BNL-837(p.91-113))
production of triple, cross section for, 18: 26300
reactions in nuclear coulomb fields, meson (3π) formation in, 18: 26300
Regge poles of, effects in photoproduction of mesons, 18: 26372
resonance mass spectra in gamma-proton interactions, 2π, 18: 26353
resonance of three, 18: 26323
theory, 18: 26667

MESONS (π^-)
interactions with protons at 1.5 to 4.2 Bev, π-ρ enhancement in, 18: 26346
interactions with protons, model for inelastic, 18: 26351
interactions with protons at 829 Mev, resonance effects in, 18: 26352
interactions with protons at 310 and 377 Mev, cross sections for ($\pi^- + \pi^0 + p$) production in, 18: 26377
photoproduction on deuterons, cross sections for, 18: 26317

MESONS (π^+)
decay ($\pi^0 + e^+ + \nu$), 18: 26273 (BNL-837(p.344-52))
interactions with polarized protons, hyperon (Σ^+) parity and spin from, 18: 26343
interactions with protons, isobar production in, 18: 26358
leptonic decay of, 18: 26349
photoproduction by polarized bremsstrahlung at 227 to 373 Mev, retardation term in, 18: 26382
photoproduction on protons, analysis of, 18: 26282
photoproduction on deuterons, cross sections for, 18: 26317
production in interactions of mesons (K^+) with protons at 910 Mev/c, 18: 26381

MESONS (ρ)
angular distributions in antiproton-proton interactions, 18: 26286
interactions with mesons (π), meson (ω) production in, 18: 26341
interactions with mesons (π), enhancement at 1 to 1.4 Bev, 18: 26346
photoproduction on nucleons, cross sections and meson exchange in, 18: 26373
production in meson (π) interactions, strip approximation for, 18: 26331
properties from meson (π) -nucleon interactions, peripheral model for, 18: 26348
Regge poles of, effects in photoproduction of mesons, 18: 26372

METAL CRYSTALS
lattice dynamics of, theory for, 18: 26142

METALLIC FILMS
thickness measurement of, design of radiometric beta gage for, 18: 25751

METALLURGY
book: *Vanadium, Niobium, Tantalum. The Metallurgy of the Pure Metals and Their Alloys*, in German, 18: 25906

METALS
atomic vibrations and melting process in, calculation of, 18: 25990
bonding dissimilar, co-extrusion, 18: 25953
book: *Rare Metals*. Vol. I. *Beryllium, Boron, Cesium, Gallium, Germanium, and Hafnium*, in German, 18: 25905
control and testing, gamma spectroscopic, 18: 25676
creep in, mathematical procedure for determining mechanisms of, 18: 25974 (EURAEC-1037)
deformation processing of, research program on, 18: 25952
fabrication of, techniques for, 18: 25955
fermion pairing in, second-kind coherent, 18: 26426

magnetic susceptibility of, 18: 26393
melting parameters and self-diffusion of cubic, empirical correlation of, 18: 25994
oxidation protection during melting and heat treatments, development of lithium-gas generator for, 18: 25933
point defect clustering in irradiated and quenched, effects of annealing on, 18: 26069(R) (ANL-6868(p.373-417))
properties for construction of high-temperature ionization chambers, 18: 25776 (AEEW-M-381)
purity requirements for, for use in reactor cores, 18: 26034
theory of, neutral pseudo-atoms in, 18: 25897
thermal decomposition of steam on, 18: 26824(R) (ANL-6885)
ultrasonic attenuation in, effect of coulomb interaction on, 18: 26408

METEORITES
abundances and isotopic compositions of elements in, review on, 18: 26201
age estimation for iron, by potassium-40/potassium-41 method, 18: 26198
ages of, radiometric estimation of, 18: 26189
rare gas content of, radiogenic, spallogenic, and primordial, 18: 26197

METEORS
shielding of space vehicles from, magnetic, 18: 26107 (ERR-FW-210)

METHACRYLIC ACID, METHYL ESTER
europium β-diketone chelate spectra in, 18: 25462
radioinduced polymerization with formaldehyde, kinetics of, 18: 25492(T) (AEC-tr-6372(p.213-22))
radioinduced polymerization with acrylonitrile, 18: 25535(T) (AEC-tr-6372(p.603-12))

METHACRYLIC ACID, METHYL ESTER POLYMERS
fabrication of light pipe using adiabatic collection, 18: 25785 (NAS-NRC-Pub-1184(p.46-7))

METHACRYLIC ACID POLYMERS
solution properties, effects of tacticity on, 18: 25463

METHANE
formation in radiolysis of polyoxymethylene at low temperature, mechanism of, 18: 25514(T) (AEC-tr-6372(p.437-43))
photochemistry of deuterated and natural, 18: 25561
radiolysis in presence of oxygen, yields from, 18: 25465 (AERE-R-4581)
radiolysis of aqueous solutions of, reactions of hydrated electron in, 18: 25579
reactions of deuterated, with hot hydrogen atoms, 18: 25597
reactions with hot deuterium atoms, 18: 25597
yields in gamma radiolysis of squalane at –196 to 350°C, 18: 25551
yields in radiolysis of acetone in aqueous solutions, acidity effects on, 18: 25582
yields in radiolysis of benzene–ethanol, 18: 25545
Ar–methane, performance as proportional counter gas, 18: 25831

METHANE, BIS(DI-n-HEXYLPHOSPHINYL)
use in reversed-phase partition chromatography of chlorides, nitrates, and perchlorates, 18: 25614

METHANE, BROMOTRIFLUORO-
neutrino interactions in, 18: 26265 (BNL-837(p.114-36))

METHANE, DICHLORO-
radioinduced polymerization with dimethylketene, products and reactivity of, 18: 25494(T) (AEC-tr-6372(p.237-46))

METHANE, DICHLORODIFLUORO-
diffusion in latex and neoprene, 18: 25315 (AWRE-O-56/57)

METHANE, IODO-
iodine exchange with iodine, photolyzed, 18: 25597
photo-oxidation of, effects of deuterium oxide and hydrobromic acid on, 18: 25587
radiolysis in olefin glasses, spectral studies on uv, 18: 25588

METHANE, TRIS(TRIFLUOROMETHYL)-
exchange between deuterium and hydrogen in methanol–sodium methoxide system, formation of perfluorocarbanions in, 18: 25451

METHANESULFONIC ACID, ETHYL ESTER
genetic effects of, in castorbean seeds, 18: 25180
genetic effects of, in barley seeds, 18: 25182

METHANOL
additive effects on radioinduced graft polymerization of polypropene to acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, 18: 25505(T) (AEC-tr-6372(p.363-9))
effects on electrolytic precipitation of nickel alloys, 18: 26057
effects on ion exchange of uranium and other elements in system with organic acids, 18: 25305
effects on radioinduced graft polymerization of styrene on celluloses, 18: 25474(T) (AEC-tr-6372(p.83-8))
effects on radioinduced graft polymerization of acrylonitrile and styrene on viscose rayon, 18: 25476(T) (AEC-tr-6372(p.97-102))
effects on yields in radiolysis of *o*- and *p*-toluenethiol, 18: 25549
electric conductivity of anhydrous uranyl nitrate in, 18: 25394
radiolysis of aqueous solutions of, reactions of hydrated electron in, 18: 25579
radiolysis of, free radical yields in gamma, 18: 25538
methanol–sodium methoxide, perfluorocarbanion formation in deuterium–hydrogen exchange in monohydrofluorocarbons in, 18: 25451

METHIONINE
radiation chemistry of, and derivatives, 18: 25573
radiation effects on metabolism of, in rabbits, 18: 25198
reaction kinetics of, in biological transmethylation, 18: 25061
S-adenosylmethionine, reaction kinetics of, in biological transmethylation, 18: 25061

METHYL GROUP
reaction kinetics of, in biological transmethylation, 18: 25061

METHYL RADICALS
reaction kinetics of, in biological transmethylation, 18: 25061

METHYL SULFOXIDE
effects on radioinduced graft polymerization of celluloses on styrene, 18: 25474(T) (AEC-tr-6372(p.83-8))
effects on radioinduced polymerization of acrylonitrile and styrene on viscose rayon, 18: 25476(T) (AEC-tr-6372(p.97-102))
reactions with niobium and tantalum pentabromides and -chlorides, properties and spectra of products in, 18: 25398

METHYLAMINE
yields in radiolysis of aqueous glycine, 18: 25584

METROLOGY
theory of, time symmetry in quantum, 18: 26417

MICE
bone marrow transplantation in irradiated, effects of irradiation of donor cells on survival and chromosome aberrations in recipients following, 18: 25201
lethal radiation dose measurements for, 18: 25165
neodymium oxide inhalation by, pathogenetic study of, 18: 25078
radiation effects on, effects of bleeding on, x, 18: 25116
radiation effects on liver regeneration in, brief and prolonged, 18: 25122
radiation effects on spleen proliferation by transplanted marrow cells in, 18: 25189
radiation effects on behavior of, chronic, early exposure, 18: 25190
radiation effects on audiogenic seizure in, gamma, 18: 25206
radiation effects on, protective effects of ethyl palmitate against, x, 18: 25216
radiation effects on response of spleen to virus infection in, 18: 25223
radiation effects on, protective effects of olive oil against, 18: 25231
radiation effects on immunological tolerance in, x, 18: 25157
radiation effects on tumor growth and metastases development from transplanted tumors in, 18: 25162
radiation effects on nucleic acid synthesis in tumors in, synergistic effects of radiomimetic drugs on, 18: 25166
radiation effects on nucleic acid synthesis in tumors in, synergistic effects of radiomimetic drug on, 18: 25173
radiation effects on desoxyribonucleic acid synthesis in *in vitro* spleen of, 18: 25186
radiation injuries in, protective effects of injected lipids against, 18: 25217
radioinduced leukemia in, effects of treatment with ACTH on, 18: 25226
radioinduced skin tumors in, 18: 25081 (AHSB(RP)R-39(p.21-9))
thymectomy effects on immunological tolerance in, 18: 25157
tritiated thymidine uptake by testes of, dose-effect measurement in, 18: 25069

MICROSCOPY
of thorium dioxide deposits in human bone marrow, 18: 25076

MICROWAVE EQUIPMENT
charged-particle radiation emission in, 18: 26150
field distributions in plasma waveguides, 18: 26778

MICROWAVES

emission by turbulent plasma, 18: 26730
emission from positive column arc discharge at cyclotron harmonics, 18: 26691 (IPPJ-23)
scattering by plasma column, resonances in, 18: 26763
use of angularly scattered, in diagnostics of cylindrical plasma, 18: 26798
uses in studies of gas-detonation plasmas, 18: 26765

MILITARY PERSONNEL
medical services for, after nuclear attack, 18: 25729

MILK
analysis for iodine-131, using scintillating organic anion exchange resin, 18: 25259 (NYO-10405)
cesium-137 content of, in southern Finland, 1961 to 1964, 18: 25687 (NP-13981)
radioactivity of Arctic, effects of fallout fission products on, 18: 25055 (NP-13985)
radioactivity of, caused by fallout strontium-90 and iodine-131, 18: 25727

MISSILES
accelerator for small high-velocity, 18: 25636

MITOSIS
effects of variability of, on cell multiplication, 18: 26982(R) (NYO-2462-1)
radiation effects on rat, x, 18: 25101

MIXER-SETTLERS
mixing of liquid phases in, apparatus for, 18: 25628(P)

MIXING
efficiency of 1000-m³ silo for cement, tracer studies of, 18: 25871 (SGAE-IB/1A-1/1964)

MOLECULAR PROPERTIES
force field parameters from isotope effects in phase equilibria, 18: 25373

MOLECULAR STRUCTURE
determination by high-resolution electron microscopes, 18: 25749(R) (ORNL-3582(p.40-1))
force field parameters from isotope effects in phase equilibria, 18: 25373

MOLECULES
dissociation and ionization of, statistical models for, 18: 26204
interactions in gases, mixed pair correlation functions for, 18: 26133
interactions with resonant cavity of electromagnetic field, quantum electrodynamics of, 18: 26399
ionization potentials of, mass spectrometer measurement of, 18: 25345
luminescence properties in liquids, 18: 25562
quantum theory of, group theory in, 18: 26438
radiation effects on, in biological systems, 18: 25105
sound propagation in gases of, disturbances in, 18: 26135
viscosity of, correlation function for hard-sphere, 18: 25362

MOLLUSKS
radionuclide uptake by clams, from water in pond, 18: 25079

MOLTEN SALT REACTOR EXPERIMENT
materials for, status of, 18: 26937

MOLYBDATE IONS
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374

MOLYBDENUM
alloying effects on niobium oxidation, 18: 25936
alloying effects on electric conductivity, hardness, and structure of niobium, 18: 25999
alloying effects on oxidation of plutonium–uranium alloys, 18: 26893(R) (ANL-6868(p.11-108))
cesium-ion sorption on, 18: 26233(T)
compatibility with fissium–plutonium–uranium alloys at 550 to 650°C, 18: 26893(R) (ANL-6868(p.11-108))
crystal deformations in, internal friction from, 18: 26041(T)
determination in trace amounts in uranium and uranium compounds, 18: 25272 (VDDIT-90)
determination in tungsten, spectrophotometric, 18: 25281
diffusion into liquid iron at 1923°K, 18: 26010
dislocation structures, 18: 26063
electric conductivity of pure monocrystalline, temperature effects on, 18: 26007
electrodeposition from molten electrolytes, 18: 25316 (BM-RI-6444)
melting temperature of, equations for calculating, 18: 25990
purification of electrodeposited, by arc-melting, 18: 25316 (BM-RI-6444)
separation from iron, steel, and tungsten by reversed-phase chromatography using hydrochloric and sulfuric acids, 18: 25280
use as barrier in bonding uranium, zirconium, and their alloys to ferrous metals, 18: 25962(P)

MOLYBDENUM ALLOYS
analysis for titanium and zirconium, plasma arc technique for spectrochemical, 18: 25268 (ML-TDR-64-36)
Al–Mo–Sn–Zr, corrosion by sodium, 18: 25937
Be–Mo, diffusion and phase studies, 18: 26013
Cr–Cu–Fe–Mo–Ni–Ti, corrosion and fabrication properties for use as nuclear fuel reprocessing plant dissolver, 18: 25996
Cr–Mo, phase diagrams, 18: 25998
Cr–Mo–Nb, properties and structure at high temperatures, 18: 26012
Cr–Mo–Nb–Ta, composition having superior high-temperature strength, 18: 25917(P)
Cr–Mo–Ta, composition having superior high-temperature strength, 18: 25917(P)
Fe–Mo, diffusion into liquid iron at 1923°K, 18: 26010
Ir–Mo, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Mo–Nb, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Mo–Nb, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Mo–Nb–Ti, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Mo–Nb–Ti, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Mo–Nb–W–Zr, homogenization kinetics of sintered, 18: 26047
Mo–Nb–W–Zr, homogenization kinetics of sintered, 18: 26052
Mo–Nb–Zr, phase studies and properties, 18: 26056
Mo–Os–W, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Mo–Pu–U, phase studies, 18: 26893(R) (ANL-6868(p.11-108))
Mo–Pu–U, properties as zero-power reactor fuels, 18: 26824(R) (ANL-6885)
Mo–Re, dislocation twinning in, mechanism, 18: 26063
Mo–Re, internal friction in deformed crystals of, 18: 26041(T)
Mo–Ti–Zr, performance as coating on fast reactor fuel elements, 18: 26824(R) (ANL-6885)
Mo–Ti–Zr, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Mo–U, dissolution of irradiated, equipment and techniques for, 18: 25610 (SGAE-CH-4/1964)
Mo–U, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Mo–U, media for dissolution of, 18: 26903
Mo–U, phase deformation in, mechanism of alpha- and gamma-, 18: 26027
Mo–U, tensile properties of quenched, 18: 26026
Mo–V, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Mo–W, casting methods for, 18: 25954
Mo–W, mechanical and physical properties of cast, 18: 25954
Mo–Zr, internal friction in deformed crystals of, 18: 26041(T)

MOLYBDENUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

MOLYBDENUM ELECTRODES
electric discharge effects on, arcing in, 18: 26806
performance in thermionic cells, 18: 26933

MOLYBDENUM ISOTOPES Mo-93
decay, 18: 26595

MOLYBDENUM ISOTOPES Mo-99
separation from uranium-238 fission products, determination of fission-rate ratio of uranium-238-to-uranium-235 from, 18: 26249

MOLYBDENUM OXIDES
preparation and properties of monocrystalline, 18: 25893(R) (ANL-6868 (p.355-72))
reduction in molten electrolytes and electrodeposition of molybdenum from, 18: 25316 (BM-RI-6444)

MOLYBDENUM SILICIDES
oxidation at 1400 to 1700°C, 18: 25928

MOLYBDENUM STEEL
Cr–Mo, corrosion by sodium at 500 to 600°C, 18: 25937
Cr–Mo, welding of thick, by electroslag techniques, 18: 25945(T,R) (EURAEC-1039)
Cr–Mo–V, creep of, enthalpy and entropy of activation of, 18: 25974

(EURAEC-1037)
MOLYBDENUM SYSTEMS
Mo–Si, diffusion reactions at 1250°C, 18: 26001
MONAZITES
analysis for cerium using potassium dichromates, potentiometric, 18: 25308
MOON
luminescence from crater Kepler on, evaluation of, 18: 26195
radiation brightness temperature at 4 mm, 18: 26192
MOSQUITOES
control of, using radiation-sterilized males, 18: 25047
MÖSSBAUER EFFECT
in gold alloys, correlation with electric conductivity, 18: 26534(R) (ORNL-3582(p.16-17))
in steel, plastic deformation effects on, 18: 25903(T)
polarization of reflected photons in, 18: 26535(R) (ORNL-3582(p.20-3))
use for nuclear and solid-state studies of iodine-129 compounds, 18: 26111 (NP-13990)
uses for measuring hfs of iron in rhodium alloys, 18: 25982(R) (ORNL-3582(p.18-19))
MOTORS
operation of stepping, control circuit for, 18: 25654(P)
MULTIPLICATION FACTOR
measurement of control rod transfer functions using pulse analyzers and cross-correlation, 18: 25813 (NAS-NRC-Pub-1184(p.207-9))
measurement of $_{94}\rho$ and δ^{49} by chemical separation of neptunium-239 and molybdenum-99 from uranium and fission products, 18: 26249
variations in boiling water reactors, minimization of mean square value of, 18: 26924(R) (EURAEC-1065)
MUSCLES
radiation effects on rabbit, fluid flow method for detection of, 18: 25134
MUTATIONS
chemically induced in barley, 18: 25182
of sorghum induced by gamma radiation or colchicine, 18: 25130
radiation effects on, in rats, 18: 25215(T) (AEC-tr-6227/1(p.25-44))
radioinduced and chemically induced, in oats, 18: 25184
radioinduced in barley, 18: 25176
radioinduced in barley, 18: 25182
radioinduced in oats, 18: 25181
radioinduced in plants, 18: 25133
radioinduced in xanthine dehydrogenase in Drosophila, effects on activity, 18: 25208
radioinduced, in cotton, 18: 25129
radioinduced, in peanuts, x, 18: 25132
radioinduced, in *Sorghum arundinaceum*, 18: 25131
radioinduced, of grass, 18: 25177

N

NAGASAKI
biological effects of atomic explosion on population of, 18: 25722
leukemia occurrence in bomb survivors in, 18: 25728
NAPHTHALENE
radioinduced polarization of fluorescence from, 18: 25594
radioinduced thermoluminescence in, factors affecting, 18: 25472(T) (AEC-tr-6372(p.61-74))
2,7-NAPHTHALENEDIOL
deuterium–hydrogen exchange in alkaline solution of, 18: 25453
NAPHTHAZARIN
complexes with hafnium, neodymium, thorium, titanium, and zirconium formation constants and spectra of, 18: 25456
solvent properties for americium and europium, 18: 25622
3-NAPHTHOIC ACID, 2-HYDROXY-
solvent properties for americium and europium, 18: 25622
2-NAPHTHOL, 1-NITROSO-
solvent properties for americium and europium, 18: 25622
NARINGIN
deuterium–hydrogen exchange in alkaline solution of, 18: 25453
NATURAL WATERS
cesium, iodine, and strontium uptake from Cape Thompson, Alaska, 18: 25688 (TID-20638)
NAVAL REACTORS
economics, 18: 26960
NEBULAE
x-ray emission by Crab, 18: 26200
NEMATODES
radiation effects on, gamma, 18: 25125
NEOCUPFERRON
solvent properties for americium and europium, 18: 25622
NEODYMIUM
determination in high-purity compounds, spectrographic, 18: 25288
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
magnetic moment of ions of, in crystalline state and in solution, 18: 25350
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
solvent extraction from nitric acid solutions by TBP, calculated cascade equilibria for, 18: 25624
spectra in thorium oxide at 100°K, nephelauxetic effects on reflection, 18: 25423
NEODYMIUM ACETYLACETONATES
stability of, effects of ionic size on, 18: 25389
NEODYMIUM AZIDES
thermal decomposition of, differential thermal analysis of, 18: 25446
NEODYMIUM CARBONATES
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354
NEODYMIUM CHLORIDES
complexes with 1,10-phenanthroline, structure and thermal stability of, 18: 25387
ethanol–$NdCl_3$, solvent properties for lanthanum, 18: 25620
NEODYMIUM COMPLEXES
with acetyl-, benzoyl-, and propionylacetonates, stability of, 18: 25389
with β-hydronaphthazarin and naphthazarin, formation constants and spectra of, 18: 25456
with bicarbonate and carbonate, ion exchange studies, 18: 25438
NEODYMIUM IONS
laser emission by cerium fluoride crystals containing, 18: 26119
NEODYMIUM ISOTOPES Nd-144
alpha decay of, energies and rates for, 18: 26640
electric dipole transitions in, nuclear structure effects on internal pair formation for, 18: 26581
NEODYMIUM NIOBATES
$CaMoO_4$–$NdNbO_4$, preparation and spectra of, 18: 26017
$CaWO_4$–$NdNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
NEODYMIUM NITRATES
complexes with TBP in aqueous solutions, spectra of, 18: 25393
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354
$Nd(NO_3)_3$–TBP–H_2O, complex formation in, 18: 25393
NEODYMIUM OXALATES
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354
NEODYMIUM OXIDES
pathogenetic effects of inhaled aerosol of, on guinea pigs and mice, 18: 25078
NEODYMIUM PERCHLORATES
thermal decomposition of, differential thermal analysis and thermogravimetric studies on, 18: 25396
NEODYMIUM PHOSPHATES
preparation and single crystal growth of ortho-, 18: 25356
NEODYMIUM SULFATES
reduction of anhydrous, by carbon monoxide, 18: 25427
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354
NEODYMIUM SYSTEMS
B–C–Nd, phase studies, 18: 25319 (COO-1140-103)
NEON
additive effects on lifetime of metastable helium atoms, 18: 26238
bubble release and swelling in solids, model for, 18: 26080
charge transfer with protons, cross sections for Lyman alpha emission from, 18: 26235

content and isotopic composition in stone meteorites, radiogenic, spallogenic, and primordial, 18: 26197
helium metastable atom scattering by, angular dependence of cross sections, 18: 26237
melting temperature of, equations for calculating, 18: 25990
photoionization cross sections at 80 to 600 A, 18: 26239
superheat in nucleate boiling of, 18: 26461
NEON IONS
electron-capture cross sections at 0.4 to 3.6 kev, 18: 26229
reactions with hydrogen molecules at 5 to 35 kev, excitation of Balmer spectral lines in, 18: 26214(T)
NEON ISOTOPES Ne-20
energy levels, 18: 26664
energy levels of, parity and spin of, 18: 26574
scattering by nuclei, strong absorption model for elastic, 18: 26563
NEON ISOTOPES Ne-22
energy levels of, parameters for excited, 18: 26645
NEON SYSTEMS
H–Ne, electron ionization coefficients, 18: 26220
NEPTUNIUM
separation from niobium and zirconium by ion exchange, 18: 25294
separation from plutonium, uranium, and other elements by ion exchange, 18: 25295
superconductivity in, search for, 18: 26473
NEPTUNIUM ALLOYS
Np–Pu, crystal structure and phase studies, 18: 25892(R) (ANL-6868 (p.234-66))
Np–Pu, preparation and properties, 18: 25892(R) (ANL-6868(p.234-66))
NEPTUNIUM CARBIDES
crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
NpC–ThC, crystal structure and phase studies, 18: 25970(R) (ANL-6868 (p.303-25))
NEPTUNIUM COMPLEXES
with oxalate ions, equilibrium solubility in perchloric and oxalic acids, 18: 25392
NEPTUNIUM ISOTOPES Np-237
nuclear magnetic moments in neptunium oxide, 18: 26522(R) (ANL-6868 (p.326-30))
production in fast power reactors, economics of, 18: 26927 (TID-20647)
NEPTUNIUM ISOTOPES Np-239
separation from irradiated uranium, determination of epicadmium-to-subcadmium neutron capture ratio from, 18: 26249
NEPTUNIUM SYSTEMS
C–Np–U, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
NERVOUS SYSTEM
radiation effects on rabbit, exposed *in utero*, 18: 25121
radiation effects on audiogenic seizure in mice and rats, gamma, 18: 25206
NEUTRINOS
detection equipment for, 18: 26166 (BNL-837(p.170-89))
interactions in Freon bubble chamber, 18: 26265 (BNL-837(p.114-36))
interactions in heavy-liquid bubble and spark chambers, 18: 26266 (BNL-837(p.160-9))
interactions of meson (μ), upper limits for, 18: 26321
interactions of, astrophysics in, 18: 26187 (BNL-837(p.193-233))
interactions with nucleons, $W^{\pm}$ production and form factors in, 18: 26268 (BNL-837(p.249-56))
production at CERN, 18: 26165 (BNL-837(p.91-113)
reactions with nuclei, W production in, 18: 26269 (BNL-837(p.257-65))
NEUTRON CAPTURE CROSS SECTIONS
measurement for chromium and chromium isotopes at 0 to 50 kev, 18: 26570
NEUTRON CROSS SECTIONS
data storage and retrieval program for Nuclear Data Library, 18: 25879 (AWRE-O-4/64)
measurement of thermal, using pulsed-source method, 18: 26828
multiple-scattering corrections to, computer program for, 18: 26530 (BNL-8028)
review of evaluations of, 18: 26559 (WASH-1047)
NEUTRON DIFFRACTION ANALYSIS
equipment and techniques for, 18: 25971(R) (ANL-6868(p.331-7))
NEUTRON MONOCHROMATORS
nonmonochromatic higher order contamination in crystal, determination of, 18: 26499 (RISO-73)
NEUTRON PHOTOGRAPHY
imaging equipment and methods in, 18: 25675(R) (ANL-6868(p.219-28))
shield enclosure for encapsulated irradiated fuel for, 18: 26068 (ANL-6799)
NEUTRON SCATTERING CROSS SECTIONS
resonance structure in continuum shell model, theory of, 18: 26531 (LADC-6007)
NEUTRON SOURCES
development and properties of actinium–beryllium, for industrial geophysics studies, 18: 25873
efficiency measurements by gold foil activation, 18: 26505
energy spectrum of americium-241–beryllium, 18: 26510
neutron emission by, absolute determination of number in, by associated particle method, 18: 26503
neutron emission by, measurement by manganese activation method, 18: 26504
neutron emission from, determination of number of simultaneous, 18: 25857(P)
neutron flux at large distance from point, air-ground interface effects on, 18: 26511
neutron flux from eccentric point, in spherical reactors, 18: 26869
NEUTRON SPECTRA
description of, in orthonormal series, 18: 26824(R) (ANL-6885)
measurement in water-moderated bare homogeneous assemblies using fission chambers, 18: 26885
measurements of fast, analysis of reliability of matrix models and methods for, 18: 26120
NEUTRON SPECTROMETERS
design of time-of-flight, for thermal velocities, 18: 25863
performance of, for neutron flux measurements, 18: 26590
pulse discriminator for time-of-flight, zero cross-over, 18: 25803 (NAS-NRC-Pub-1184(p.146-9))
NEUTRONS
absorption by moderator-containing control rods, calculation of effectiveness of, 18: 26832
absorption by multilayer control rods, calculation of effectiveness of, 18: 26831
absorption by nuclei, optical model calculations of cross sections for, 18: 26663
ages in concrete at 1.44 ev to 2.5 Mev, 18: 26515
angular correlations with gamma rays in deuteron reactions (d,nγ) with boron-11 at 1.0 and 0.7 Mev, 18: 26680
biological effects, 18: 25095(T) (FTD-TT-63-1046)
capture by chromium-51, L/K ratio in, 18: 26665
capture by thorium, measurement of resonance integrals for, 18: 26821
capture in charged-particle stripping reactions with nuclei, Coulomb distortions in, 18: 26646
capture in heterogeneous reactor fuel elements, variational principle for resonance, 18: 26870
capture of, gamma spectra and giant resonances in, 18: 26611
detection and measurement using d-c fission chamber filled with helium, 18: 25777 (AEEW-M-395)
detection and measurement of, fission chambers for in-pile, 18: 25780(R) (GEAP-4604)
detection of, review on, 18: 25850
determination of number of simultaneously emitted, method and device for, 18: 25857(P)
diffusion length and pulse parameters for water, 18: 26516
diffusion of, energy averaging of coefficients for, 18: 26517
dose rates in shelters, effects of compartmentalization on, 18: 25712 (USNRDL-TR-722)
effects on electrochemical behavior of iron and steel, 18: 25553
effects on hydrogen adsorption by aluminum oxide, 18: 25468 (BNL-845)
effects on in-pile thermionic materials, 18: 26259
effects on potassium chloride, chemical states of phosphorus-32 produced in, 18: 25567
effects on pressure vessel steel, 18: 26925 (GEAP-4423)
effects on rat stress accommodation, 18: 25100
effects on reactor materials tensile properties, 18: 26096
effects on secondary breakdown in transistors, 18: 25756

emission from source, absolute determination of number in, by associated particle method, 18: 26503
emission in compound-nucleus reactions forming polonium-210, 18: 26647
flux at large distance from point source of, air-ground interface effects on, 18: 26511
flux control in high-temperature BBC/KRUPP, 18: 26968
flux distribution determination from activity of medium flowing in reactor, 18: 26865(T) (AEC-tr-6227/1(p.47-9))
flux distribution measurements in high-temperature BBC/KRUPP Reactor, 18: 26967
flux from eccentric point source in spherical reactors, buckling in, 18: 26869
flux measurements of, from T(d,n) reaction, 18: 26590
form factors of, from meson (π) electroproduction, 18: 26312
interactions with neutrinos, form factors in, 18: 26268 (BNL-837 (p.249-56))
interactions with protons, potentials for, 18: 26285
interactions with protons at 1.6 Bev/c in bubble chamber, pion production by, 18: 26376
mass difference between protons and, dispersion calculations of, 18: 26374
mass difference between protons and, from tritium (p,n) reactions, 18: 26616
monochromatization of, higher order contamination in, 18: 26499 (RISO-73)
reactions (n,γn) with gallium, cross sections for, 18: 25300
reactions (n,α) with lanthanum-139, alpha energy spectrum for, 18: 26606
reactions (n,p) of, emulsion plate camera for measuring, 18: 25866
reactions in beryllium–uranium critical assemblies, 18: 26248
reactions with curium-244 at 0.01 to 900 ev, total cross sections for, 18: 26650
reactions with gold foil, absolute measurement of efficiency of neutron sources by, 18: 26505
reactions with manganese, absolute measurement of efficiency of neutron sources by, 18: 26504
scattering by aluminum, beryllium, carbon, iron, and polyethylene, dose measurements in small-volume, 18: 26532 (NAA-SR-9418)
scattering by carbon-12 at 14.1 Mev, elastic and inelastic, 18: 26600
scattering by crystal lattices, one-phonon, 18: 26130
scattering by crystals and fluids, 18: 26509
scattering by crystals, phonon spectra from incoherent, 18: 26520(T)
scattering by intermediate and heavy nuclei at 0.5 to 0.8 Mev, cross sections for elastic, 18: 26568
scattering by light and intermediate nuclei at 0.5 to 0.8 Mev, cross sections for, 18: 26571
scattering by magnesium-24 to 14.1 Mev, 18: 26600
scattering by nuclei at small angles, cross section increase in, 18: 26519
scattering by nuclei at 2 to 6 Mev, resonance structures in continuum-shell-model, 18: 26531 (LADC-6007)
scattering by nuclei, optical model calculations of cross sections for, 18: 26663
scattering by silicon-28 at 14.1 Mev, 18: 26600
scattering by spin fluctuation in pyrrhotite, temperature dependence of inelastic, 18: 26498 (PAN-280)
scattering by sulfur-32 at 14.1 Mev, 18: 26600
scattering of, computer program for angular distributions and cross sections for compound-nuclear-state, 18: 26556 (ORNL-TM-875)
scattering of, laboratory experiments at Dutch high-flux reactor on, 18: 26965
separation energies for, 18: 26576
slowing down in beryllium, 18: 26248
slowing down in infinite homogeneous media, Boltzmann equation for, 18: 26500
slowing down in infinite homogeneous media, Boltzmann equation for, 18: 26501
slowing down in infinite media, chemical binding and thermal motion effects on, 18: 26513
spectra of, from proton reactions at 4 to 14 Mev, 18: 26601
thermalization in zirconium hydride, measurement of, 18: 26514
thermalization in water, parameters for, 18: 26871
transport equation computer code, two-dimensional multigroup, 18: 26497 (AWRE-O-66/63)
transport in cylindrical and slab geometries, discrete-ordinates method for, 18: 26512
transport in cylindrical lattices, collision probabilities for, 18: 26872
transport in fast reactors, 22-group constants for, 18: 26824(R) (ANL-6885)
transport in infinite media, generalization of Fick's law for, 18: 26518
transport in infinite slab reactors, equations for, 18: 26867
transport in reactors, equations for, 18: 26866
transport theory for, correlation functions in invariant imbedding, 18: 26508
yields from nitrogen-14 (d,n) reactions at 1.4 to 3.8 Mev, 18: 26673
yields in helium ion fission of rhenium and thorium-232 at energies up to 40 Mev, 18: 26670

NEUTRONS, COLD
scattering by liquids, microdynamic structural study from, 18: 26507

NEUTRONS, FAST
absorption dose of, in bone marrow, 18: 25048
biological effects of, in mice, 18: 25165
capture by even zirconium isotopes, s-wave strength functions from, 18: 26544(R) (ORNL-3582(p.82-4))
dosimetry in tissues, problems in, 18: 25107
effects on fluorescence spectra of uranyl ion in cesium uranyl nitrate, 18: 25554
effects on microstructure of pressure vessel-grade steel, 18: 26092
effects on strength of aluminum–copper and copper single crystals, 18: 26074
exponential experiments using, theory of, 18: 26877
flux distribution in atmosphere, 18: 26101
lethal dosage determinations of, for mice, 18: 25165
pathological effects in barley, 18: 25178
reactions (n,γ) with fluorine-19, spectra from resonant, 18: 26541(R) (ORNL-3582(p.68-71))
reactions with graphite, induced dimension changes in, 18: 26095
reactions with nuclei, total cross sections for, 18: 26543(R) (ORNL-3582(p.75-82))
reactions with praseodymium at 14-Mev, total cross section for, 18: 26577
scattering by carbon-12, cross sections for elastic, 18: 26547(R) (ORNL-3582(p.93-4))
scattering by heavy weight nuclei at 4.0 to 6.5 Mev, 18: 26671
scattering by lead-208 at 0.7 to 1.9 Mev, 18: 26545(R) (ORNL-3582 (p.86-90))
scattering by medium weight nuclei at 4.0 to 6.5 Mev, 18: 26668
scattering by oxygen-16, cross sections for, 18: 26546(R) (ORNL-3582 (p.90-2))
transport in steel and uranium blocks, 18: 26521
uses for determining nuclear radii of tin isotopes, 18: 26538(R) (ORNL-3582(p.56-7))

NEUTRONS, RESONANCE
absorption by tungsten nuclei at 4 to 27 ev, 18: 26539(R) (ORNL-3582 (p.58-60))
reactions (n,γ) with tin nuclei, spectra from, 18: 26540(R) (ORNL-3582 (p.62-7))
reactions (n,γ) with fluorine-19, spectra from, 18: 26541(R) (ORNL-3582(p.68-71))
reactions (n,γ) with nuclei having A = 23 to 32, spectra from, 18: 26542(R) (ORNL-3582(p.71-5))
reactions with nuclei, total cross sections for, 18: 26543(R) (ORNL-3582(p.75-82))

NEUTRONS, THERMAL
buckling measurements in water–natural uranium exponential pile, 18: 26880
capture by nuclei, gamma spectra from, 18: 26666
diffusion in beryllium absorption cross sections and transfer and diffusion lengths for, 18: 26502
diffusion in two-layer medium, 18: 26506
diffusion parameters for water, 18: 26828
flux calculations for fuel element, 18: 26899 (HW-50086)
genetic effects in grass seeds, 18: 25177
reactions (n,γ) with tin nuclei, spectra from, 18: 26540(R) (ORNL-3582 (p.62-7))
reactions (n,f) with plutonium-239 and uranium-235, interference effects

in fission cross sections for, 18: 26569
reactions with oriented uranium-235, distributions from fission, 18: 26554(R) (ORNL-3582(p.121-6))
scattering by aluminum, beryllium, and bismuth, cross sections for, 18: 26662
scattering by binary rare earth alloys, magnetic, 18: 25980(R) (ORNL-3582(p.9-10))
scattering by chromium–palladium alloys, magnetic, 18: 25978(R) (ORNL-3582(p.5-6))
scattering by chromium–manganese alloys, magnetic, 18: 25979(R) (ORNL-3582(p.7-8))
scattering by hot gases, use for temperature measurement, 18: 26157
scattering by iron–palladium–rare earth alloys, magnetic, 18: 25977(R) (ORNL-3582(p.2-4))
uses for determining nuclear radii of tin isotopes, 18: 26538(R) (ORNL-3582(p.56-7))

NEVADA
geologic map of Topopah Spring SW Quadrangle, 18: 26986 (TEI-846)

NEVADA (LINCOLN CO.)
geologic map of Paiute Ridge Quadrangle, 18: 26984 (TEI-826)

NEVADA (NYE CO.)
geologic map of Paiute Ridge Quadrangle, 18: 26984 (TEI-826)
geologic map of Skull Mountain Quadrangle, Nevada Test Site, 18: 26985 (TEI-845)

NEVADA TEST SITE
geologic map of Skull Mountain Quadrangle, 18: 26985 (TEI-845)

NICKEL
corrosion by fluorine-gas mixtures at 450 to 500°C, 18: 26824(R) (ANL-6885)
corrosion of pure and thoria-dispersed, by oxygenated steam at 650°C and water at 360°C, 18: 25919(R) (ANL-6868(p.190-200))
determination in hydrogenated and nonhydrogenated fats, activation, 18: 25282
determination in steel by x-ray fluorescence, 18: 25275
diffusion in gamma uranium, 18: 25969(R) (ANL-6868(p.287-302))
electrolytic deposition with niobium, tantalum, titanium, and zirconium from anhydrous solutions, 18: 26057
helium-3 elastic scattering at 20 Mev, differential cross sections, 18: 26681
impregnation of carbon by liquid, 18: 25957(P)
ion exchange behavior in organic solvents containing organic acids, 18: 25305
melting temperature of, equations for calculating, 18: 25990
mixing with copper in fluidized-packed beds, particulate movement in, 18: 25658
neutron scattering cross sections at 0.5 to 0.8 Mev, 18: 26571
protective effects against nucleic acid decomposition by nuclease, 18: 25085 (SGAE-BL-5/1964)
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
solvent partition in aqueous bromide–TBP systems, 18: 25382
thermal properties, 18: 26896(R) (ANL-6868(p.133-74))

NICKEL ALLOYS
crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Au–Ni, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))
Be–Ni, phase studies, 18: 26005
Cr–Cu–Fe–Mo–Ni–Ti, corrosion and fabrication properties for use as nuclear fuel reprocessing plant dissolver, 18: 25996
Cr–Fe–Ni, corrosion of Incoloy 800 by steam, 18: 26824(R) (ANL-6885)
Cr–Fe–Ni, electron-microprobe analysis for components, 18: 25269(R) (NLCO-905)

NICKEL CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

NICKEL COMPLEXES
with dialkyl phosphoric acids, preparation and properties, 18: 25429
with substituted 2-(pyridyl) and 2-(quinolyl)-1,3-indanediones, acid dissociation and formation constants of, 18: 25457

NICKEL ELECTRODES
performance in thermionic cells, 18: 26933
radiation effects on, gamma, 18: 26067(R) (AI-8971)

NICKEL ISOTOPES Ni-58
alpha reactions to 48 Mev, shell effects in, 18: 26599
nucleon interactions in, potentials for, 18: 26638

NICKEL ISOTOPES Ni-62
proton scattering by, at 17.5 Mev, 18: 26536(R) (ORNL-3582(p.54))

NICKEL NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

NICKEL OXIDES
reactions with oxides of europium and dysprosium, 18: 26896(R) (ANL-6868(p.133-74))
Cr_2O_3–NiO, analysis by x-ray fluorescence, 18: 25275
Fe_2O_3–NiO, analysis by x-ray fluorescence, 18: 25275

NICKEL PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

NICKEL STEEL
Cr–Ni–Ti–W, analysis of carbide phase isolated from, activation, 18: 25289

NICKEL SYSTEMS
Al–Ni–Si, corrosion behavior and mechanical properties in high-temperature water, 18: 25931

NICKEL ZINC FERRITES
magnetic properties, 18: 26058

NIMONIC-80
corrosion by sodium at 650°C, 18: 25937

NIOBIUM
book: *Vanadium, Niobium, Tantalum. The Metallurgy of the Pure Metals and Their Alloys*, in German, 18: 25906
compatibility with fissium–plutonium–uranium and plutonium–uranium alloys at 550 to 650°C, 18: 26893(R) (ANL-6868(p.11-108))
corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
current fluctuations in superconducting, 18: 26484
determination in tantalum and tantalum oxides of, spectrophotometric, 18: 25284
diffusion in gamma uranium, 18: 25969(R) (ANL-6868(p.287-302))
electrolytic deposition with nickel, tantalum, titanium, and zirconium, 18: 26057
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
neutron elastic scattering at 5.0 Mev, angular distribution, 18: 26668
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26668
oxidation in hydrochloric, nitric, phosphoric, and sulfuric acids and sodium hydroxide, anodic, 18: 25929
oxidation of, effects of alloying on, 18: 25936
performance in superconducting storage systems for memory devices, 18: 26490
phase transformations in thin foils of, containing interstitials, 18: 25992
separation from neptunium and zirconium by ion exchange, 18: 25294
use for superconducting transformers, 18: 26466

NIOBIUM ALLOYS
book: *Vanadium, Niobium, Tantalum. The Metallurgy of the Pure Metals and Their Alloys*, in German, 18: 25906
coating development for oxidation protection, 18: 25896(R) (PF-63-3)
electric conductivity, hardness, and structure of, 18: 25999
Au–Nb–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Co–Nb–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Co–Nb–Ta, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Cr–Mo–Nb, properties and structure at high temperatures, 18: 26012
Cr–Mo–Nb–Ta, composition having superior high-temperature strength, 18: 25917(P)
Cr–Nb, cellular precipitation of intermetallic compound $NbCr_2$ in, 18: 26022
Cr–Nb, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Fe–Nb, diffusion into liquid iron at 1923°K, 18: 26010
Hf–Nb, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Ir–Nb, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Ir–Nb, phase studies, 18: 25988
Ir–Nb–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))

Mo–Nb, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Mo–Nb, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Mo–Nb–Ti, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Mo–Nb–Ti, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Mo–Nb–W–Zr, homogenization kinetics of sintered, 18: 26047
Mo–Nb–W–Zr, homogenization kinetics of sintered, 18: 26052
Mo–Nb–Zr, phase studies and properties, 18: 26056
Nb–Pd, phase studies, 18: 25988
Nb–Pd–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Nb–Pt, phase studies, 18: 25988
Nb–Pt–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Nb–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868 (p.303-25))
Nb–Rh, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Nb–Rh, phase studies, 18: 25988
Nb–Rh–Ru, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Nb–Ru, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Nb–Sn, critical currents of superconducting, 18: 26464
Nb–Sn, surface impedance in superconducting, 18: 26489
Nb–Ti, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Ti, flux jumping and training in superconducting solenoids of, 18: 26470
Nb–Ti–V, compatibility with sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Nb–Ti–V, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Ti–Zr, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Ti–Zr, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Nb–V, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Nb–W–Zr, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Nb–Zr, coating development for oxidation protection, 18: 25896(R) (PF-63-3)
Nb–Zr, compatibility with fissium–plutonium–uranium alloys at 550 to 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Zr, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Zr, dimensional changes during annealing in, temperature gradient effects on, 18: 26028
Nb–Zr, energy gap of high-field superconducting, 18: 26481
Nb–Zr, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Zr, flux jumping and training in superconducting solenoids of, 18: 26470
Nb–Zr, phase studies, 18: 26003
Nb–Zr, properties for superconducting solenoids, 18: 26474
Nb–Zr, radiation effects on tensile properties of, 18: 26096
Nb–Zr, tensile properties at 20 to 950°C, 18: 25966(R) (ANL-6868 (p.120-32))

NIOBIUM BROMIDES
reactions with dimethyl- and diphenyl sulfoxides, properties and spectra of products in, 18: 25398

NIOBIUM CARBIDES
crystal structure, 18: 25970(R) (ANL-6868(p.303-25))

NIOBIUM CHLORIDES
reactions with dimethyl- and diphenyl sulfoxides, properties and spectra of products in, 18: 25398
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

NIOBIUM SYSTEMS
H–Nb, structural phase studies on, 18: 26024

NITRATES
metabolism by plants, tracer studies of effects of copper on, 18: 25059(T) (OTS-63-11008(p.6-14))

NITRIC ACID
analysis for arsenic, copper, and zinc, activation, 18: 25286
corrosive effects on niobium and vanadium, effects of acidity and current density on anodic, 18: 25929
$Gd(NO_3)_3$–HNO_3–H_2O–$Y(NO_3)_3$, phase studies, 18: 25434
HF–HNO_3, solvent properties for thorium dioxide–uranium dioxide powders, 18: 25608 (ORNL-TM-867)
$Hg(NO_3)_2$–HNO_3, solvent properties for aluminum–uranium alloys, 18: 25269(R) (NLCO-905)
HNO_3–2-propanol–H_2O, ion exchange of rare earths from, 18: 25395
HNO_3–2-propanol–H_2O, lead complexing in, 18: 25384
HNO_3–2-propanol, sorption of thorium and uranium by ion exchange from, 18: 25383
$La(NO_3)_3$–HNO_3–H_2O–$Y(NO_3)_3$, phase studies, 18: 25434

NITROGEN
additive effects on lifetime of metastable helium atoms, 18: 26238
diffusion in graphite, counter, 18: 26061
diffusion in latex and neoprene, 18: 25315 (AWRE-O-56/57)
diffusion in solid ytterbium, internal friction in interstitial, 18: 26050
heat transfer for, nucleate boiling, 18: 26462
ionization potential in reactions with carbon monoxide ions, 18: 26229
reactions with beryllium at 1000 to 1500°C, kinetics and products of, 18: 25328(R) (SC-DC-64-864)
superheat in nucleate boiling of, 18: 26461
uptake by plants from ammonia and nitrates, tracer studies of effects of copper on, 18: 25059(T) (OTS-63-11008(p.6-14))

NITROGEN IONS
energy distribution of fragment, 18: 25763
ionization of argon by 8 to 100 kev, 18: 26217

NITROGEN ISOTOPES N-12
energy levels of, shell model LS coupling, 18: 26624

NITROGEN ISOTOPES N-14
deuteron reactions (d,n) at energies up to 3.8 Mev, angular distributions and yields of neutrons from, 18: 26673
deuteron reactions (d,α), theoretical and experimental angular distributions, 18: 26675
energy separation and nuclear-force charge dependence in, isobaric-triplet, 18: 26618
gamma reactions (γ,p) at 15.5 to 30.5 Mev, 18: 26633
proton inelastic scattering at 9.15 to 10.45 Mev, energy level excitation in, 18: 26605
scattering by nuclei, strong absorption model for elastic, 18: 26563

NITROGEN OXIDES
decomposition of nitrous oxide using oxide catalysts, 18: 25893(R) (ANL-6868(p.355-72))
oxidation of graphite by, kinetic anisotropy in, 18: 25932
radioinduced formation of, in air, 18: 25718
NO_2–dimethylpropane, photolysis and pyrolysis, free radical reactions in, 18: 25329 (TID-20645)

NOISE
measurement of, errors in, 18: 25760

NOZZLES
fluid flows through, analysis of two-phase, 18: 26824(R) (ANL-6885)

NUCLEAR BATTERIES
electricity production from reactor fission products, 18: 26254
magnetron effect from cathodes in plasma diodes in, geometric dependence of, 18: 26256

NUCLEAR ELECTRIC MOMENTS
from beta decay, survey, 18: 26679

NUCLEAR EMULSIONS
efficiency in multiplate proton cameras, 18: 25866
electron radiation length in, at 800 Mev, 18: 26295
meson (K^-) reactions at 1.5 Bev/c, lithium-8 fragments from, 18: 26636

NUCLEAR ENGINEERING
engineering materials list, 18: 26987 (TID-4100(Suppl. 21))
research progress in, Boris Kidric Institute of Nuclear Sciences, Belgrade, Yugoslavia, 18: 26989(T) (AEC-tr-6227/1)

NUCLEAR MAGNETIC MOMENTS
from beta decay, survey, 18: 26679

NUCLEAR MAGNETIC RESONANCE
double resonance studies of sodium–ammonia solutions, 18: 26154
measurement in intermetallic compounds and solid solutions, 18: 26522(R) (ANL-6868(p.326-30))
measurements at high temperature, furnace and probe assemblies for, 18: 25758

NUCLEAR MATERIALS MANAGEMENT
accidents in fuel fabrication and radioisotope processing plants, theoretical possibilities and consequences of, 18: 25711 (ORNL-3441)

analytic problems in uranium refining, 18: 25619
economy of nuclear fuels, 18: 26904
in chemical processing of radioisotopes, 18: 25607 (ORNL-3633)
in radioactive waste management avoiding environmental disposal, 18: 26979
in transportation of radioactive materials, 18: 25713 (VDDIT-89)
indexes to ORNL master analytical manual, 18: 25271 (TID-7015 (Indexes)(Rev.1))
uranium processing at NLCO, 18: 25269(R) (NLCO-905)
uranium-235 determination in absolute air filters, nondestructive method for, 18:25270 (NYO-10726)

NUCLEAR MODELS
angular momentum distribution in Thomas-Fermi, 18: 26578
beta decay transitions, 18: 26679
phosphorus-29 energy levels with strong- and weak-coupling models, 18: 26594
review, 18: 26667
unitary symmetry, mass of Z^- particle in, 18: 26315

NUCLEAR MODELS (DROP)
charged particles emission in, 18: 26629

NUCLEAR MODELS (OPTICAL)
analysis of (He-3,t) reactions, 18: 26596
helium-3 elastic scattering by metals at 20 Mev, differential cross sections, 18: 26681
neutron scattering and absorption cross section calculations by, 18: 26663
scattering of spinless charged particles by even-even nuclei, calculations, 18: 26678
scattering theory for, matrix elements and parity rules for inelastic, 18: 26651

NUCLEAR MODELS (SHELL)
fluorine-19 energy levels in, negative-parity, 18: 26592
mass-12 energy levels from, 18: 26624
neutron resonance scattering structures in continuum, configuration mixing in, 18: 26531 (LADC-6007)
oxygen-18 energy levels from, potentials for, 18: 26639

NUCLEAR PHYSICS
electromagnetic cross sections for electron and nuclear research, 18: 26684

NUCLEAR POWER
book: *From the Atomic Nucleus to the Nuclear Power Station*, in German, 18: 26943
development in Victoria, Australia, evaluation of, 18: 26929
economics in Iowa power system, analysis, 18: 26944
economics of, with uranium from ocean and rocks, 18: 26917 (DM-72)
production of, review of developments in, 18: 26931

NUCLEAR POWER PLANTS
boiler design for gas-cooled-reactor, 18: 26941
design and development of Gundremmingen, in 1963, 18: 26918(R) (EUR-1802.d)
design for improved efficiency, 18: 26951(P)
design requirements for manned lunar power station, 18: 26956 (MTP-ASTR-A-63-8)
development and testing of Latina station, 18: 26921(R) (EUR-1810.i)
development and testing of nuclear-thermoelectric, 18: 26251(R) (AD-437280)
economic aspects of large, 18: 26993
economics of, calculation of size for optimum, 18: 26934
turbine exhaust wetness reduction in, methods for, 18: 25660
use of gas turbine in boiling-water-reactor, 18: 26942
use of mercury–steam binary power cycle in, 18: 26949

NUCLEAR REACTIONS
book: *From the Atomic Nucleus to the Nuclear Power Station*, in German, 18: 26943
distorted-wave Born approximation and stripping matrix element with finite range, 18: 26626
electromagnetic cross sections for electron and nuclear research, 18: 26684
mechanisms of, angular correlations of excitation functions in, 18: 26634
nature and importance of, review on, 18: 26572
pair production, cross section calculations for, 18: 26380
theory, 18: 26667
theory of charged-particle stripping, Coulomb distortions in, 18: 26646
theory of, independence hypothesis in statistical, 18: 26529 (BNL-8020)

NUCLEAR SPIN
polarization time in solid dielectrics, electron-resonance excitation in, 18: 26652

NUCLEAR STRUCTURE
effects on internal pair formation, 18: 26581

NUCLEAR THEORY
book: *Nuclear Interactions*, 18: 26667
data on M4 transitions, 18: 26208
independence hypothesis in statistical theory of nuclear reactions, 18: 26529 (BNL-8020)

NUCLEI
alignment and polarization of I = 1, 18: 26598
book: *From the Atomic Nucleus to the Nuclear Power Station*, in German, 18: 26943
charged particle elastic scattering by, strong absorption model for, 18: 26563
charged particle emission, deformed model for, 18: 26629
charged particle scattering by even-even, optical model calculations of spinless, 18: 26678
charged-particle stripping reactions with, Coulomb distortions in neutron capture in, 18: 26646
decay and formation of compound nucleus system in nuclear reactions, independence of, 18: 26529 (BNL-8020)
deuteron elastic scattering at 10 Mev, 18: 26561
electric dipole transitions in, theory of internal pair formation for, 18: 26581
electron backscattering from, formulas for equivalent atomic number of complex targets for saturation in, 18: 26660
electron scattering by, relaxation paths for elastic, 18: 26371
energy level densities of A = 40 to 70, 18: 26597
energy levels of A = 12, in shell model with LS coupling, 18: 26624
energy levels of even-even, interpretation of 5^-, 18: 26579
energy-level spacing distributions in, 18: 26587
energy-level spectra of, statistical theory of, 18: 26588
excitations of, Fermi-liquid model for collective, 18: 26612
fission at high energies, fragmentation in, 18: 26608
gamma angular correlation data on aligned, method for analysis of, 18: 26637
hyperon (Λ) trapping in, 18: 26623
interactions of heavy, with cosmic fragments at energies greater than 1000 Bev, 18: 26378
meson (K^-) reactions at 1.5 Bev/c, lithium-8 fragments from, 18: 26636
meson (μ^-) capture, coupling constants in, 18: 26523 (BNL-837(p.292-7))
meson (π) reactions in, meson (3π) formation in, 18: 26300
neutrino reactions, W production in meson (μ)-, 18: 26269 (BNL-837 (p.257-65))
neutron capture by, gamma spectra from, 18: 26666
neutron scattering at small angles, cross section increase in, 18: 26519
nucleon angular momentum distribution in, 18: 26578
transition spectra in, Alaga's rules for electromagnetic, 18: 26628
transitions in even-even, M_1–E_2 mixing ratio of $2^+ \rightarrow 2$, 18: 26580

NUCLEI (CELLS)
radiation dose to mouse testes, following tritiated thymidine injection, 18: 25069
radiation effects on dimensions of, in leaf tissue of sugar beets, 18: 25136

NUCLEIC ACIDS
radiation effects on synthesis of, in strain L cells, gamma, 18: 25209
radiation effects on nuclease decomposition of, in presence of trace elements, 18: 25085 (SGAE-BL-5/1964)
radiation effects on metabolism of, in barley seed embryos, 18: 25175
radiosensitivity of infectious, of tobacco mosaic viruses, 18: 25159

NUCLEONS
angular momentum distribution in nuclei, 18: 26578
interactions in nuclei, potentials for, 18: 26638
interactions in oxygen-18, velocity-dependent potentials for, 18: 26639
interactions of, theory for, 18: 26667
interactions with gamma radiation, polarization dependence of single meson (π) production in, 18: 26276 (DESY-64/6)
interactions with hyperons (Λ), detection of resonances in, 18: 26277(R)

(ORNL-3582(p.127-8))
interactions with mesons (π), production processes in, 18: 26281
interactions with mesons (π), models for elastic, 18: 26281
interactions with mesons (π) at low energies, equations for, 18: 26299
interactions with mesons (μ), meson (π) production in, 18: 26305
interactions with mesons (π), mesons (ρ) in, 18: 26348
interactions with mesons (π), resonance effects in, 18: 26352
interactions with bosons, isobar production in, 18: 26358
interactions with nucleons in nuclear matter, Moszkowski and Scott approximation of Brueckner's many-body theory of, 18: 26369
interactions with photons, meson (π) production in, 18: 26372
interactions with photons, production of mesons (ω) and mesons (ρ) in, 18: 26373
interactions with photons at high energy, Regge poles in pion production in, 18: 26385
interactions with neutrinos (μ), upper limits for, 18: 26321
scattering by nuclear matter, collective excitations in, 18: 26612

O

OAK RIDGE NATIONAL LAB., TENN.
analytical methods used at, indexes to master manual of, 18: 25271 (TID-7015(Indexes)(Rev.1))
analyzer systems at, survey of, 18: 25745 (NAS-NRC-Pub-1184(p.40-1))
isotopic target preparation at, 18: 25877 (ORNL-3400)
OATS
chemically induced mutations in, 18: 25184
radioinduced monosomes in *Avena Sativa* L, properties of x, 18: 25207
radioinduced mutations in, 18: 25184
radiosensitivity of seeds of, effects of moisture content on, 18: 25181
OCTANE
yields in gamma, radiolysis of squalane at −196 to 350°C, 18: 25551
2-OCTANONE
formation in radioinduced telomerization of acetaldehyde with cyclohexene or hexene, 18: 25510(T) (AEC-tr-6372(p.405-12))
1-OCTENE
radiolysis of, spectral studies on gamma, 18: 25588
2-OCTENE
radiolysis of, spectral studies on gamma, 18: 25588
OILS
analysis for sulfur by combustion, 18: 25302
OLEIC ACID, CHOLESTERYL ESTER
protective effects of injected, against radiation injuries in mice, 18: 25217
OLEIC ACID, ETHYL ESTER
protective effects of injected, against radiation injuries in mice, 18: 25217
OLEIN
protective effects of injected, against radiation injuries in mice, 18: 25217
OLIVE OIL
protective effects against x radiation in mice, 18: 25231
protective effects of injected, against radiation injuries in mice, 18: 25217
ONIONS
radiosensitivity of seeds of, effects of aging on, 18: 25179
OPTICAL SYSTEMS
design of high-resolution annular, for electron microscopy, 18: 25749(R) (ORNL-3582(p.40-1))
ORGANIC COMPOUNDS
analysis for carbon-14 by radiometric methods, 18: 25293
electric surface potentials of aqueous solutions of, use of plutonium-239 for measuring, 18: 25450
radiation chemistry, 18: 25591
radioinduced addition reactions of free radicals with, 18: 25466 (AERE-R-4587)
ORGANS
protective effects of sterilized organolysates of, against radiation sickness in rats, 18: 25219
radiation effects on, 18: 25105
radiosensitivity of, effects of dose fractionation on, 18: 25192
ORNL HIGH FLUX ISOTOPE REACTOR
description, 18: 26962 (ORNL-3572)
OSCILLOGRAPHS
digital interrogator for pulse analyzer displays, light-probe, 18: 25825 (NAS-NRC-Pub-1184(p.313-19))
OSMIUM ALLOYS
Hf–Os–Zr, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Mo–Os–W, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
OSMIUM CHLORIDES
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
OSMIUM ISOTOPES Os-185
transition spectra in, Alaga's rules for electromagnetic, 18: 26628
OSMIUM ISOTOPES Os-191
beta decay, iridium-191 energy levels from, 18: 26620
OXALATE COMPLEXES
with neptunium, equilibrium solubility in perchloric and oxalic acids, 18: 25392
OXALIC ACID
equilibrium solubility of neptunium oxalate complexes in, 18: 25392
OXAZOLE, 2,2'-*p*-PHENYLENEBIS[5-PHENYL-
scintillation properties in liquid helium, 18: 25849
OXETANES
radioinduced polymerization of derivatives of, 18: 25497(T) (AEC-tr-6372(p.273-86))
radioinduced polymerization of, crystal structure of polymers produced in, 18: 25501(T) (AEC-tr-6372(p.311-21))
radioinduced polymerization of solid, epitaxy in, 18: 25502(T) (AEC-tr-6372(p.323-30))
radioinduced polymerization of, activation energy and kinetics of, 18: 25503(T) (AEC-tr-6372(p.331-47))
OXIDATION
measurement of, graphite electrode development for, 18: 25320 (COO-1148-84)
protection of metals against, development of lithium-gas generator for, 18: 25933
OXIMES
isatin-β-, solvent properties for americium and europium, 18: 25622
OXONIUM IONS
formation and detection in radiolysis of water, 18: 25576
OXYGEN
additive effects on radiolysis of butyl chloride, 18: 25598
binding to hydrogen in water, isotopic substitution effects on, 18: 25417(T)
bleaching effects on radioinduced optical absorption bands in polystyrene, 18: 25568
chemical effects on yields from radiolysis of methane, 18: 25465 (AERE-R-4581)
consumption rates in normal and irradiated tissues, 18: 25168
corrosive effects on zinc, tracer studies on, 18: 25927
determination in argon and helium, instruments for, 18: 25264 (CNLM-4016)
determination in aqueous solutions by gas chromatography, 18: 25273(T) (AEC-tr-6227/1(p.9-14))
determination in steel, activation, 18: 25304
diffusion in latex and neoprene, 18: 25315 (AWRE-O-56/57)
diffusion in solid ytterbium, internal friction in interstitial, 18: 26050
diffusion in tungsten and other refractory metals, thermodynamics of, 18: 26035
effects on cysteamine formation in irradiated cystamine, 18: 25542
effects on radiation chemistry of aqueous solutions, 18: 25580
effects on radioinduced polymerization of liquid acrylamide, 18: 25536(T) (AEC-tr-6372(p.613-16))
effects on reparation in x-irradiated *E. coli*, 18: 25229
electron reactions at 0 to 300 ev with chemisorbed, 18: 26206
formation in pulsed electron beam radiolysis of aqueous solutions, 18: 25578
heat transfer for, nucleate boiling, 18: 26462
helium ion charge transfer to, cross sections for, 18: 25377
neutron total cross section at 14 Mev, 18: 26577
oxidation of graphite by, kinetic anisotropy in, 18: 25932
oxygen ion charge transfer to, cross section for, 18: 25377
radiation effects on consumption of, by chicken embryonic intestine,

18: 25124
reactions with beryllium at 1000 to 1500°C, kinetics and products of, 18: 25328(R) (SC-DC-64-864)
superheat in nucleate boiling of, 18: 26461
OXYGEN IONS
charge transfer to oxygen, cross section for, 18: 25377
ionization of argon by 8 to 100 kev, 18: 26217
production in electron bombardment of oxygen at 0 to 300 ev, 18: 26206
OXYGEN ISOTOPES O-14
energy separation and nuclear-force charge dependence in, isobaric-triplet, 18: 26618
OXYGEN ISOTOPES O-15
production of excited, by nitrogen-14 (d,n) reactions, 18: 26673
OXYGEN ISOTOPES O-16
content in ratio with oxygen-18 in calcium carbonate Pleistocene varved clays from Toronto, Canada, 18: 25695
deuteron elastic scattering at 10 Mev, angular distributions for, 18: 26561
electron inelastic scattering by, energy-level excitation by, 18: 26609
meson (μ^-) capture, coupling constants in, 18: 26523 (BNL-837(p.292-7))
neutron scattering by, cross sections at 3 to 4 Mev, 18: 26546(R) (ORNL-3582(p.90-2))
proton reactions (p,He-3) and (p,t) at 43.7 Mev, 18: 26653
reactions (^{16}O,f) with erbium-170 and tungsten-182 at 102 to 165 Mev, energy-mass distributions in, 18: 26558 (UCRL-11377)
scattering by even cadmium isotopes, Coulomb excitation from, 18: 26551(R) (ORNL-3582(p.107-11))
scattering by nuclei, strong absorption model for elastic, 18: 26563
scattering by selenium-76 and -78 at 37 Mev, inelastic, 18: 26610
OXYGEN ISOTOPES O-17
energy levels of, lifetime of first excited, 18: 26641
OXYGEN ISOTOPES O-18
alpha elastic scattering at 2.4 to 3.5 Mev, differential cross sections for, 18: 26645
content in ratio with oxygen-16 in calcium carbonate Pleistocene varved clays from Toronto, Canada, 18: 25695
energy levels of, shell model calculations of, 18: 26639
isotopic analysis of, design of thermostat for densimetric, 18: 25750 (PAN-459/XVI)
nucleon interactions in, potentials for, 18: 26638
nucleon interactions in, velocity-dependent potentials for, 18: 26639
proton reactions (p,n) at 3.5 to 10 Mev, 18: 26601
OXYGEN SYSTEMS
C–Fe–O, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
F–O, corrosive effects on nickel at 450 to 500°C, 18: 26824(R) (ANL-6885)
H–O–Ti, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
O–Pu, phase studies, 18: 26060
O–Pu–U, phase studies, 18: 26060
O–Ta–Ti–Zr, phase studies, 18: 26053
O–Ta–W, phase studies of products of reactions of tantalum and tungsten oxides at 1000 and 1200°C, 18: 25444
O–U, phase studies, 18: 26060
OZONE
radioinduced formation of, in air, 18: 25718

P

PACIFIC OCEAN
radioactivity of air and water in, 131° 57'E to 164° 00'W longitude and 52° 57' to 08° 45'N latitude, 1961, 18: 25690
PACKAGE POWER REACTORS
development of Vulcain, Belgian and UK, 18: 26969
PAINTS
radiation effects on, for space vehicle thermal control, 18: 26097
PAIR PRODUCTION
cross section for, 18: 26684
in electric dipole transitions, effects of nuclear structure on internal, 18: 26581
PALLADIUM
alloying effects on niobium oxidation, 18: 25936
alloying effects on electric conductivity, hardness, and structure of niobium, 18: 25999
diffusion in copper and silver, 18: 25969(R) (ANL-6868(p.287-302))
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
thermoelectric powers to 900°C, 18: 25970(R) (ANL-6868(p.303-25))
PALLADIUM ALLOYS
Au–Pd, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))
Co–Pd, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Cr–Pd, antiferromagnetism in, 18: 25978(R) (ORNL-3582(p.5-6))
Cr–Pd, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Fe–Pd, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Fe–Pd–rare earth, magnetic moment alignment in dilute, 18: 25977(R) (ORNL-3582(p.2-4))
Mn–Pd, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Nb–Pd, phase studies, 18: 25988
Nb–Pd–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Pd–Ta, phase studies, 18: 25988
Pd–Ta, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Pd–U, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Pd–V, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Pd–W, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Pd–W, phase studies at 1100 to 1815°C, 18: 26023
PALLADIUM ISOTOPES Pd-103
diffusion in copper, palladium, and silver, 18: 25969(R) (ANL-6868 (p.287-302))
PALMITIC ACID (LABELED)
protective effects against x radiation in mice, 18: 25216
protective effects of injected, against radiation injuries in mice, 18: 25217
PARABIOSIS
of rabbits, use in studies of radiation effects on blood picture in, 18: 25150
PARAFFIN
gamma spectra in, 18: 26820
shielding properties of, gamma, 18: 26820
PARAMAGNETIC MATERIALS
effects on nuclear resonance of lithium-7, rubidium-87, and sodium-23, 18: 25425
PARTICLE STATISTICS
energy state and occupation number fluctuations in, 18: 26411
PARTICLES
counting, queueing theory, 18: 25890
motion about mass center, convergence of approximation for relativistic, 18: 26397
PASSIVATION
of heat exchanger surfaces in atomic industry, 18: 25914(P)
PATHOLOGY
disaster reactions and treatment of, 18: 25731
1-PENTADIENE
radiolysis of, spectral studies on gamma, 18: 25588
PENTAERYTHRITOL
radiation effects on structure of, 18: 26083
2,4-PENTANEDIONE COMPLEXES
with europium, laser properties of, 18: 25445
with lanthanum, stability of, 18: 25389
2,4-PENTANEDIONE, HEXAFLUORO-
complexes with europium, laser properties of, 18: 25452
complexes with europium, luminescence of, 18: 25558
2,4-PENTANEDIONE, TRIFLUORO-
complexes with europium, laser properties of, 18: 25452
2-PENTANONE, 4-METHYL-

solvent properties for plutonium from aqueous nitric acid solutions, 18: 25604 (CRC-487)
1-PENTENE
radiolysis of, spectral studies on gamma, 18: 25588
2-PENTENE
radiolysis of, spectral studies on gamma, 18: 25588
1-PENTENE, 2-METHYL-
radiolysis of, spectral studies on gamma, 18: 25588
PENTYL DISULFIDE
radioinduced ionic paramagnetic species in, gamma, 18: 25557
PERCHLORIC ACID
effects on reactions between hydrogen peroxide and plutonium, 18: 25390
equilibrium solubility of neptunium oxalate complexes in, 18: 25392
$HClO_4$–TBP, solvent properties for europium, lanthanum, and ytterbium, 18: 25381
PEROXIDASES
radiation effects on activity in Mycobacteria of, x, 18: 25111
PEROXIDES
formation in post-irradiation polymerization of trioxane, 18: 25500(T) (AEC-tr-6372(p.299-310))
PERSONNEL
of radiology departments in hospitals, radiation protection of, 18: 25721
radiation dosimetry of, exposed occupationally, 18: 25717
selection for work with radiation, criteria for, 18: 25716
PERTURBATION THEORY
eigenvalue problems in, determinantal method for, 18: 25886
formalism for plasma stability, 18: 26747
interactions of intense radiation fields with atoms, 18: 26423
scattering in three-body systems, 18: 26432
scattering-amplitude high-energy behavior and partial wave singularities in, 18: 26322
symmetry in particle models, trio-invariant, 18: 26325
PHANTOMS
gamma dose distribution in water, from collimated source, 18: 25245
x-ray scattering dose in water, 18: 25255
PHENANTHROLINE COMPLEXES
with rare earth chlorides and thiocyanates, structure and thermal stability of, 18: 25387
PHENOL
thermal and radioinduced polymerization of, products of, 18: 25496(T) (AEC-tr-6372(p.261-72))
PHLORIZIN
deuterium–hydrogen exchange in alkaline solution of, 18: 25453
PHLOROGLUCINOL
deuterium–hydrogen exchange in alkaline solution of, 18: 25453
PHONONS
interactions with electrons, thermodynamic potential of, 18: 26143
scattering by mass defects in solids, theory of, 18: 26212
PHOSPHATE GLASS
radiophotoluminescence in, stability of, 18: 26076
PHOSPHATES
radiation effects on *E. coli* pyridoxal, x, 18: 25103
PHOSPHINE OXIDE, TRIOCTYL-
use in reversed-phase partition chromatography of chlorides, nitrates, and perchlorates, 18: 25614
PHOSPHINES
dichlorophenyl-, chlorine isotopic exchange with tetraethylammonium chloride, 18: 25441
PHOSPHONITRILE CHLORIDES
radioinduced polymerization of, products of, 18: 25496(T) (AEC-tr-6372(p.261-72))
PHOSPHORIC ACID
corrosive effects on niobium and vanadium, effects of acidity and current density on anodic, 18: 25929
PHOSPHORIC ACID, ALKYL ESTERS
complexes with metals, physical properties, 18: 25429
dioctyl-, solvent properties for americium and europium, 18: 25622
solvent properties for uranium(VI), 18: 25623
solvent properties of mixed aryl, for beryllium from aqueous acid solutions, 18: 25625(P)
PHOSPHORIC ACID, ARYL ESTERS
solvent properties for beryllium from aqueous acid solutions, 18: 25625(P)
PHOSPHORS
development of liquid helium, 18: 25849
efficiency of thallium-activated sodium iodide crystal, 18: 25865
meson (μ) ionization energy loss in, 18: 25842
preparation and properties of copper-activated thorium phosphate, 18: 25376
properties of distyrylbenzene, 18: 25559
properties of organic-gel, for beta counting, 18: 25864
response of plastic, to 1- to 10-kev photons, 18: 25845
synthesis and efficiency of scintillating organic resin for detection of radionuclides in solutions, 18: 25259 (NYO-10405)
PHOSPHORUS
content in marine rocks in Israel, 18: 25686
PHOSPHORUS ISOTOPES P-29
energy levels, 18: 26593
energy levels of, in strong- and weak-coupling models, 18: 26594
PHOSPHORUS ISOTOPES P-31
deuteron reactions (d,α), theoretical and experimental angular distributions, 18: 26675
energy levels, spin-parity of 3.13-Mev, 18: 26635
proton reactions (p,2p) at 185 Mev, 18: 26567
PHOSPHORUS ISOTOPES P-32
effects on enzyme activity in blood and liver of rats, 18: 25154
formation by $^{32}S(n,p)^{32}P$ reaction, 18: 26590
formation of, by irradiation of metal sulfates in reactors, 18: 25615
production by proton reactions in thick iron targets, cross sections for, 18: 26583
production in neutron radiolysis of potassium chloride, chemical states of, 18: 25567
separation from sulfates on alumina column, 18: 25615
skin dose calculations for, 18: 25083 (AHSB(RP)R-39(p.44-68))
PHOSPHORYL CHLORIDES
chlorine isotopic exchange with tetraethylammonium chloride, 18: 25441
PHOTOELECTRIC CELLS
development of silicon, for gamma dose rate measurements, 18: 25833
PHOTOELECTRIC EFFECT
in superconductors, 18: 26494(T)
PHOTOGRAPHIC FILM
exposure curves for, used in Van de Graaff accelerator industrial applications, 18: 26175
PHOTOGRAPHY
of radioactive materials, equipment and procedures for, 18: 26991
PHOTOMESONS
production of (π^+) by polarized bremsstrahlung at 227 to 373 Mev, retardation term in, 18: 26382
PHOTOMULTIPLIER TUBES
gain stabilization of, constant-amplitude light flash generator for, 18: 25817 (NAS-NRC-Pub-1184(p.220-8))
light pipe fabrication using lucite strips for adiabatic collection, 18: 25785 (NAS-NRC-Pub-1184(p.46-7))
noise rejection using standard amplifier and gating system, 18: 25802 (NAS-NRC-Pub-1184(p.143-5))
PHOTONS
absorption by nuclei, cross section for, 18: 26564
hydrogen ionization by two, atomic, 18: 26218
interactions with bosons in quantum electrodynamics, Feynman diagrams for, 18: 26419
interactions with protons, meson (π^+) production in, 18: 26282
interactions with protons at 0.2 to 1 Bev, Compton effect in, 18: 26298
interactions with photons at 0.2 to 1 Bev, Compton effect in, 18: 26298
interactions with fermions, parity-determining boson-producing, 18: 26310
interactions with photons, in double-dispersion representation, 18: 26318
interactions with protons, 2π mass spectra in, 18: 26353
interactions with nucleons, meson (π) production in, 18: 26372
interactions with nucleons, production of mesons (ω) and mesons (ρ) in, 18: 26373
interactions with nucleons at high energy, Regge poles in pion production in, 18: 26385

interactions with deuterons, meson ($\pi^{\pm}$) production in, 18: 26317
propagation in field theory, charged vector boson effects on, 18: 26338
PHOTOPROTONS
production in carbon-12 at 20 to 22 Mev, resonances, 18: 26674
PHOTOSENSITIVITY
of metaphosphate glass microdosimeters in dark storage, 18: 26076
PHTHALIC ACID
precipitation of cerium and lanthanum using, 18: 25351
PHYSICS
progress at ORNL in, annual summary, 18: 26113(R) (ORNL-3582)
PHYTIC ACID
radioinduced cross-linking in resin with maleic acid and propylene glycol, hardening in, 18: 25527(T) (AEC-tr-6372(p.533-8))
PIEZOELECTRIC CRYSTALS
charged particle energy losses by coupling of electric and elastic fields in, 18: 26370
PIGMENTS
radiation effects on anthocyanin formation in detached flower petals of *Impatiens balsamina*, 18: 25064
PINACOL
yields in radiolysis of acetone in aqueous solutions, acidity effects on, 18: 25582
PINCH EFFECT
diagnostics of azimuthal, magnetic-probe, 18: 26735
diffusion of current layer in one-dimensional magnetic, analysis, 18: 26804
plasma instability in Z-, excitation of, 18: 26733
plasmoids in, theory of force-free, 18: 26751
PIPERIDINE
radioinduced crosslinking reactions with epoxy resin, hardening in, 18: 25528(T) (AEC-tr-6372(p.539-46))
PIPES
development for superheaters, 18: 26946
liquid flow in stationary porous, spiral, 18: 25669
PITCHBLENDES
technetium-99 content in, 18: 25705
PLANTS
analysis for cerium-144, 18: 25265 (HASL-143)
cesium, iodine, and strontium adsorption by, from natural waters, Cape Thompson, Alaska, 18: 25688 (TID-20638)
mutations of sorghum, induced by gamma radiation or colchicine, 18: 25130
nitrogen uptake from ammonia and nitrates, tracer studies of effects of copper on, 18: 25059(T) (OTS-63-11008(p.6-14))
radiation effects on anthocyanin formation in flower petals of *Impatiens balsamina*, 18: 25064
radioinduced and chemically induced mutations in oats, 18: 25184
radioinduced mutations in cotton, 18: 25129
radioinduced mutations of *Sorghum arundinaceum*, 18: 25131
radioinduced mutations in peanut, x, 18: 25132
radioinduced mutations of *Phaseolus mungo*, 18: 25133
strontium content in vegetables in India, 18: 25067
PLASMA
acceleration by gradients of static magnetic and electromagnetic fields, 18: 26742
acceleration of exploding-film, pulsed, 18: 26809
acceleration of, electrodynamics in, 18: 26770
accelerator for, for inducing fusion reactions, 18: 26810(P)
book: *Electrodynamics of Plasmas Based on Statistical Mechanics, Vol. I, Physical Processes and Mathematical Methods*, 18: 26793
charged particle escape from, in magnetic bottle, 18: 26799
charged particle reactions with quantized, energy transfer in, 18: 26749
charged-particle energy loss in active, 18: 26791
charged-particle motion in rarefied, theory of, 18: 26688 (ARL-64-60)
charged-particle motion in magnetic-mirror, 18: 26702(T) (AEC-tr-5589 (p.637-77))
compression in increasing magnetic field, 18: 26698(T) (AEC-tr-5589 (p.565-84))
compression of loop of, in Zh-0 installation, 18: 26704(T) (AEC-tr-5589 (p.689-708))
conference on, 18: 26694(T) (AEC-tr-5589)
containment by toroidal trap with cusped geometric field, 18: 26783
containment by traveling-wave field, 18: 26709(T) (AEC-tr-5589 (p.869-87))
containment in finite-minima fields, maximum pressure for, 18: 26760
containment of, MHD theory of, 18: 26718
containment of, self-, 18: 26758
cyclotron radiation from, collective effects in, 18: 26803
diagnostics of cylindrical, using angularly scattered microwaves, 18: 26798
diffusion in magnetic field, 18: 26772
diffusion of weakly-ionized helium, in magnetic field, 18: 26768
electric and magnetic field distributions in rotating, at thermodynamic equilibrium, 18: 26717
electric conduction and luminosity of external detonation-generated, effects of air on, 18: 26796
electric conductivity of fully ionized, h-f, 18: 26759
electromagnetic field distributions in, 18: 26778
electromagnetic fluctuations in rarefied, magnetized electron, ideal resonator of, 18: 26724
electromagnetic transverse wave propagation along magnetic field in, 18: 26713
electromagnetic wave propagation across cylindrical, in window problem, 18: 26690 (D1-82-0217)
electromagnetic waves in, ion-beam excitation of, 18: 26722
electromagnetic wave absorption and dispersion in low-density, 18: 26731
electromagnetic wave propagation into vacuum, criteria for, 18: 26755
electromagnetic wave scattering from driven oscillations in, incoherent, 18: 26756
electromagnetic wave propagation in, in strong magnetic field, 18: 26784
electromagnetic-wave propagation in, 18: 26699(T) (AEC-tr-5589 (p.596-611))
electromagnetic-wave interactions in, 18: 26723
electromagnetic-wave propagation in layers of, 18: 26725
electromagnetic-wave propagation in weakly dispersive, 18: 26727
electron gyroresonance radiation in equilibrium magneto-active, 18: 26721
electron oscillations in two-temperature Maxwellian, linearized transport treatment of, 18: 26801
electrostatic fields in, correlation functions for, 18: 26750
energy dissipation, measurements of, 18: 26779
energy losses from, bolometer measurements of, 18: 26780
field structure in zero-permeability layer of, 18: 26726
flow around electric conductors, 18: 26774
flow in electric and magnetic fields, stress tensor for, 18: 26734
fluctuations in nonequilibrium, 18: 26707(T) (AEC-tr-5589(p.831-60))
hydromagnetic equilibria in, at high pressures, 18: 26762
hydromagnetic wave propagation in cylindrical, boundary conditions at insulating wall for, 18: 26728
instabilities in one-dimensional, computer model studies of, 18: 26800
interactions of positive-column, with inhomogeneous high-frequency field, 18: 26776
interactions with high-frequency field, 18: 26775
interactions with charged-particle beams, oscillations from, 18: 26781
interactions with electron beams, instability in, 18: 26706(T) (AEC-tr-5589(p.767-72))
ion cyclotron resonance in, review on, 18: 26739
ion energies in, in magnetic-mirror traps, 18: 26701(T) (AEC-tr-5589 (p.626-36))
ion oscillations in, collision effects on, 18: 26737
ionic-sound excitation in positive-column, 18: 26703(T) (AEC-tr-5589 (p.678-88))
ionization phenomena of hydrogen in pulsed discharge, role of dissociation in, 18: 26716
kinetics of, nonequilibrium statistical mechanics for, 18: 26753
magneto conductivity tensor of anisotropic quantum, 18: 26761
magnetoacoustic resonance in, 18: 26700(T) (AEC-tr-5589(p.612-25))
microwave emission from positive-column at cyclotron harmonics, 18: 26691 (IPPJ-23)
microwave emissivity of turbulent, 18: 26730
motion of cylindrical bunches of, radiation emission from, 18: 26788
motion of helical, in cusped magnetic field configuration, 18: 26741
oscillations in magnetic field, high-frequency, 18: 26777

penetration into evacuated region in magnetic field, 18: 26711(T) (FTD-TT-64-400)
photon-photon scattering cross section for, quantum-mechanical calculation of, 18: 26692 (NP-14011)
pinch discharge in, instabilities in Z-, 18: 26733
pinch discharge in, magnetic-probe studies of azimuthal, 18: 26735
positron interactions with, 18: 26789
production by exploding wires under water, temperature of, 18: 26754
production in arc-heater coaxial flow discharge, hot-gas containment limits for, 18: 26687 (ARL-64-49)
production in detonation of gas mixtures in metal tubes, microwave studies of, 18: 26765
production in spatially periodic magnetic field, 18: 26705(T) (AEC-tr-5589(p.758-66))
production of high-energy, electric arc device for, 18: 26811(P)
production of high-density gaseous, studies of, 18: 26797
propagation across azimuthal magnetic field, 18: 26773
reducing effects of thermal-ion, on uranium oxides, 18: 25269(R) (NLCO-905)
research on, review of, 18: 26764
resonances in, microwave-scattering, 18: 26763
shock propagation in, in transverse magnetic fields, 18: 26752
shock waves in dilute, 18: 26697(T) (AEC-tr-5589(p.554-64))
shock waves in fully ionized perfect gas, properties of plane perpendicular, 18: 26693 (RISO-76)
shock waves in, laminar theory of, 18: 26740
spectra emitted by aluminum ions in, line broadening and splitting in, 18: 26710(T) (AEC-tr-6227/1(p.15-24))
spectra of pulsed, electron optics for recording, 18: 26743(T)
stability in a magnetic mirror trap, 18: 26695(T) (AEC-tr-5589(p.83-96))
stability in conducting and counterstreaming, electrostatic, 18: 26732
stability in mirror fields, 18: 26744
stability in reflection discharge, macroscopic, 18: 26782
stability of heterogeneous, in magnetic field, 18: 26767
stability of stationary motions in, linear, 18: 26738
stability of, criteria for, 18: 26745
stability of, effects of compressibility on hydromagnetic Kelvin-Helmholtz, 18: 26794
stability of, perturbation equations for, 18: 26747
statistical theory of, kinetic equation of, 18: 26686 (ARL-64-44(Pt.II))
temperature of, spectroscopic measurement of ion, 18: 26708(T) (AEC-tr-5589(p.861-8))
theory for weakly unstable, 18: 26712
theory of force-free plasmoids, 18: 26751
transport coefficients for nonisothermal, totally ionized, 18: 26769
transport of three-component, in magnetic field, 18: 26771
wave growth and stability in slightly ionized, 18: 26689 (BSD-TDR-64-34)
wave interactions in, collisions effects on, 18: 26766
wave propagation in, solutions for non-linear stationary, 18: 26729
wave propagation in collision-free, 18: 26746
wave propagation in fully ionized, longitudinal, 18: 26757
wave propagation in, transverse to magnetic field, 18: 26785
waves in, nonlinear stationary, 18: 26736

PLATES

elastic constants of, vibration method for determining, 18: 25679
fabrication of tungsten, by powder metallurgy, 18: 25944(R) (N63-14854)
flow pressure drop across thick, with restrictions, 18: 25665
fluid flow up vertical, MHD, 18: 26124
transient forced convection from flat, subjected to step energy input, 18: 25666

PLATINUM

exploding wire phenomena in, plasma production in underwater, 18: 26754
melting point of, correlation with energy of motion of monovacancies, 18: 26037
melting temperature of, equations for calculating, 18: 25990
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26671
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374

PLATINUM ALLOYS

Au–Pt, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))
Mn–Pt, crystal and magnetic structure of $PtMn_3$, 18: 25971(R) (ANL-6868(p.331-7))
Nb–Pt, phase studies, 18: 25988
Nb–Pt–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Pt–Ta, phase studies, 18: 25988

PLATINUM CHLORIDES

separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

PLATINUM METALS

crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))

PLUTONIUM

abstracts on developments in technology of, May 1, 1964, 18: 26981 (HW-68600-38)
analysis for boron, oxalate separation for spectrophotometric, 18: 25266 (HW-28529)
analysis for tantalum using trioctylamine, emission spectrographic, 18: 25279
analysis of, review of methods and difficulties in, 18: 25291
crystal structure and phase studies, 18: 25892(R) (ANL-6868(p.234-66))
determination in urine, comparison of two extraction methods for, 18: 25299
development and properties as reactor fuel, 18: 26895(R) (ANL-6868 (p.117-19))
development, fabrication, and economics of fuel elements of, 18: 25947
extrusion and properties of wire of, 18: 25895(R) (NUMEC-2389-3)
fabrication and properties of alpha, 18: 25892(R) (ANL-6868(p.234-66))
grain growth and recrystallization in alpha, 18: 25892(R) (ANL-6868 (p.234-66))
metallography, 18: 25892(R) (ANL-6868(p.234-66))
preparation of high-purity, 18: 25892(R) (ANL-6868(p.234-66))
properties for use as reactor fuel, survey of, 18: 25995
radiation self-damage in metastable β-phase, 18: 26075
reactions with hydrogen peroxide in acid solutions, 18: 25390
separation from aqueous nitric acid solutions by solvent extraction using hexone, 18: 25604 (CRC-487)
separation from neptunium, uranium, and other elements by ion exchange, 18: 25295
separation from nitric acid solutions by solvent extraction using triethylene glycol dichloride, 18: 25603 (CEI-18)
separation from nitric acid solutions by oxalate precipitation, apparatus for continuous, 18: 25626(P)
separation from reactor fuels, 18: 25630(P)
spectra in nitric acid and triethylene glycol dichloride solutions, absorption, 18: 25603 (CEI-18)
spectra in nitric acid and hexone solutions, absorption, 18: 25604 (CRC-487)
superconductivity in, search for, 18: 26473
use of radioactive electrodes of, for measuring electric surface potential of organic bases, 18: 25450

PLUTONIUM ALLOYS

compatibility with refractory alloys and metals, 18: 26893(R) (ANL-6868 (p.11-108))
properties for use as reactor fuel, survey of, 18: 25995
Al–Pu, compatibility with Zircaloy-2 at 600°C, 18: 26893(R) (ANL-6868 (p.11-108))
Fe–Pu–U, properties as zero-power reactor fuels, 18: 26824(R) (ANL-6885)
fissium–Pu–U, fabrication and properties as reactor fuel, 18: 26893(R) (ANL-6868(p.11-108))
fissium–Pu–U, performance as fast reactor fuels, 18: 26824(R) (ANL-6885)
Mo–Pu–U, phase studies, 18: 26893(R) (ANL-6868(p.11-108))
Mo–Pu–U, properties as zero-power reactor fuels, 18: 26824(R) (ANL-6885)
Np–Pu, crystal structure and phase studies, 18: 25892(R) (ANL-6868 (p.234-66))
Np–Pu, preparation and properties, 18: 25892(R) (ANL-6868(p.234-66))
Pu–Th–U, crystal structure and phase studies, 18: 25966(R) (ANL-6868 (p.120-32))
Pu–U, compatibility with niobium at 550 to 650°C, 18: 26893(R)

(ANL-6868(p.11-108))
Pu–U, fabrication and properties as reactor fuel, 18: 26893(R) (ANL-6868(p.11-108))
Pu–U, oxidation by air at 24°C, effects of aluminum, carbon, copper, iron, molybdenum, and zirconium additions on, 18: 26893(R) (ANL-6868(p.11-108))
Pu–U, performance as fast reactor fuels, 18: 26824(R) (ANL-6885)
Pu–U, phase studies, 18: 26893(R) (ANL-6868(p.11-108))
Pu–U, properties as zero-power reactor fuels, 18: 26824(R) (ANL-6885)
PLUTONIUM CARBIDES
burnup testing of niobium–zirconium and type 304 stainless steel-clad, 18: 26893(R) (ANL-6868(p.11-108))
crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
preparation and properties as reactor fuel, 18: 26896(R) (ANL-6868(p.133-74))
production, 18: 26893(R) (ANL-6868(p.11-108))
PuC–ThC, crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
PuC–UC, burnup testing of type 304 stainless steel-clad, 18: 26893(R) (ANL-6868(p.11-108))
PuC–UC, preparation and properties as reactor fuel, 18: 26896(R) (ANL-6868(p.133-74))
PuC–UC, production, 18: 26893(R) (ANL-6868(p.11-108))
PLUTONIUM COMPOUNDS
properties for use as reactor fuel, survey of, 18: 25995
PLUTONIUM ISOTOPES
production in synchrocyclotrons, 18: 26169 (NP-13973)
PLUTONIUM ISOTOPES Pu-237
deuteron fission at 21 Mev, cross sections for formation of cesium-134 isomeric pair in, 18: 26585
PLUTONIUM ISOTOPES Pu-239
determination in urine, comparison of two extraction methods for, 18: 25299
fission of, alpha angular distribution in ternary, 18: 26557 (PAN-481/I)
neutron fission at low energies, interference effects in cross sections for, 18: 26569
skin dose calculations for, 18: 25083 (AHSB(RP)R-39(p.44-68))
uptake by deer lungs, 18: 25693
use of electrodes of, for measuring electric surface potential of organic bases, 18: 25450
PLUTONIUM NITRIDES
preparation and properties, 18: 26896(R) (ANL-6868(p.133-74))
PLUTONIUM OXALATES
precipitation from nitric acid solutions, apparatus for continuous, 18: 25626(P)
PLUTONIUM(IV) OXALATES
processing into plutonium dioxide powders, 18: 26901(R) (NUMEC-2389-2)
PLUTONIUM(IV) OXIDES
crystal structure and phase studies, 18: 25893(R) (ANL-6868(p.355-72))
electric conductivity, 18: 25893(R) (ANL-6868(p.355-72))
preparation and properties of spherical particles of, 18: 26008
preparation of powders of, by oxalate precipitation, 18: 26901(R) (NUMEC-2389-2)
separation from uranium(IV–VI) oxide, fluoride-volatility, 18: 26824(R) (ANL-6885)
thermodynamic properties, 18: 25893(R) (ANL-6868(p.355-72))
PuO_2–ThO_2, preparation and properties of spherical particles of, 18: 26008
PuO_2–UO_2, preparation, impurity pickup in hammermilling stage, 18: 25895(R) (NUMEC-2389-3)
PuO_2–UO_2, preparation and properties of spherical particles of, 18: 26008
PuO_2–ZrO_2, preparation and properties of spherical particles of, 18: 26008
PLUTONIUM PHOSPHIDES
preparation and properties, 18: 26896(R) (ANL-6868(p.133-74))
PLUTONIUM SULFIDES
preparation and properties, 18: 26896(R) (ANL-6868(p.133-74))
PLUTONIUM SYSTEMS
properties for use as reactor fuel, survey of, 18: 25995
O–Pu, phase studies, 18: 26060
O–Pu–U, phase studies, 18: 26060
POLONIUM ISOTOPES Po-210
production in compound-nucleus reactions, gamma and neutron emission from, 18: 26647
use as cathode heater for vacuum tubes, feasibility study of, 18: 25870 (MLM-1154)
POLYMERIZATION
radioinduced epitactic, 18: 25502(T) (AEC-tr-6372(p.323-30))
radioinduced in monomers and polymers, research on, 18: 25525(T) (AEC-tr-6372(p.503-10))
POLYMERS
radiation effects on ESR spectra of, research on, 18: 25525(T) (AEC-tr-6372(p.503-10))
radiation research on annual report of Japanese Assoc. for, Vol. III, 18: 25470(T) (AEC-tr-6372)
radioinduced in 3,3-*bis*-chloromethylcycloxabutane, diketene, β-propiolactone, and trioxane, crystal structure of, 18: 25501(T) (AEC-tr-6372(p.311-21))
POLYOXYMETHYLENES
radiation effects at low temperature on, mechanism of, 18: 25514(T) (AEC-tr-6372(p.437-43))
radiation effects on ESR spectra of, comparison of trioxane to, 18: 25516(T) (AEC-tr-6372(p.455-8))
POLYSACCHARIDES
protective effects against x radiation in rabbits, 18: 25218
POPULATIONS
biological effects of atomic explosions on, mathematical analysis of, 18: 25722
genetic effects of strontium-90 in fallout in human, 18: 25697
infant mortality rates in, effects of irradiation of fetuses during diagnostic radiographic examination of mothers, 18: 25151
PORCELAIN
electric discharge thermal shock effects on, 18: 26806
electric properties, 18: 26058
PORES
coalescence and migration in solids, 18: 26069(R) (ANL-6868(p.373-417))
POROUS MATERIALS
thermal conductivity of sintered, 18: 25987(T) (NP-tr-1247)
POROUS METALS
coalescence and migration of pores in, 18: 26069(R) (ANL-6868(p.373-417))
POSITRONIUM
decay in water, magnetic quenching of, 18: 26221
POSITRONS
annihilation in ionized hydrogen gas, 18: 26789
scattering by point charges, wave functions for, 18: 26279
POTASSIUM
content in marine rocks in Israel, 18: 25686
elastic constants of, calculation, 18: 26142
melting temperature of, equations for calculating, 18: 25990
optical absorption of, collective resonance in, 18: 26226
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
sound absorption in liquid, magnetically induced, 18: 26131
specific heat of, calculation, 18: 26142
POTASSIUM BROMIDES
radiation effects on electric conductivity and microhardness of lead-containing, x-, 18: 25585(T)
samarium spectra in crystals of, at low temperatures, 18: 25406(T)
spectra in, optical absorption, 18: 25408
POTASSIUM CHLORIDES
radiation effects on dislocation distribution and microhardness of, 18: 26082
radiation induced V_3 centers in, optical bleaching of, 18: 26084
radiation induced color centers in, F-aggregate, 18: 26087
radiolysis of, chemical states of phosphorus-32 produced in neutron, 18: 25567
samarium spectra in crystals of, at low temperatures, 18: 25406(T)
spectra in, optical absorption, 18: 25408
spectra of, F-center electron-spin double resonance, 18: 25412
$CaCl_2$–KCl, vapor pressure, 18: 25435
KCl–$SmCl_3$, vapor pressure, 18: 25435

$KCl–SrCl_2$, vapor pressure, 18: 25435
$KCl–YbCl_2$, vapor pressure, 18: 25435
LiCl–KCl, electric conductivity of molten, 18: 26019
$LiCl–KCl–UCl_3$, purification of uranium by electrorefining of, 18: 25399
LiCl–KCl, thermodynamic properties of uranium tetrachloride in fused solutions, 18: 25340

POTASSIUM CHROMATES
analytical use in potentiometric determination of cerium, iron, and vanadium, 18: 25308

POTASSIUM FLUOBORATES
$B_2O_3–KF–KBF_4–K_2ZrF_6$, electric conductivity, 18: 25432

POTASSIUM FLUORIDES
spectra in, optical absorption, 18: 25408
$B_2O_3–KF–KBF_4–K_2ZrF_6$, electric conductivity, 18: 25432

POTASSIUM FLUOZIRCONATES
$B_2O_3–KF–KBF_4–K_2ZrF_6$, electric conductivity, 18: 25432

POTASSIUM IODIDES
spectra in, optical absorption, 18: 25408

POTASSIUM ISOTOPES K-40
gamma radiation from, contribution to radioactivity of air, 18: 25694

POTASSIUM ISOTOPES K-42
production in proton reactions with silver at 2.9 Bev, range studies of, 18: 26648

POTASSIUM ISOTOPES K-43
production in proton reactions with silver at 2.9 Bev, range studies of, 18: 26648

POTASSIUM NITRATES
electric conductivity of molten, direct current measurement of, 18: 26018
radioinduced luminescence in, mechanisms of gamma, 18: 25586(T)
$KNO_3–NaNO_3$, electric conductivity of molten, 18: 26018
$LiNO_3–KNO_3$, electric conductivity of molten, 18: 26018
$LiNO_3–KNO_3–NaNO_3$, electric conductivity at 134 to 384°C, 18: 26020

POTASSIUM OXIDES
$B_2O_3–K_2O$, radiation effects on ESR spectra of, 18: 26079

POTASSIUM PERCHLORATES
preparation by anodic oxidation of calcium or lithium chlorides, equipment and method for, 18: 25386

POWDER METALLURGY
uses for fabrication of tungsten plates and sheets, 18: 25944(R) (N63-14854)

POWDERS
atomizing and micropulverizing reactor fuel, 18: 26893(R) (ANL-6868 (p.11-108))

POWER BREEDER REACTORS
analysis of Rapsodie configuration in ZPR-III, 18: 26824(R) (ANL-6885)

POWER REACTORS
control rod operation in SIMEA, 18: 26923(R) (EUR-1810.i(Paper 6))
design and development of KRB, in 1963, 18: 26918(R) (EUR-1802.d)
design of Gundremmingen, 18: 26932
design with horizontal fuel rods, 18: 26953(P)
development and testing of SIMEA, 18: 26921(R) (EUR-1810.i)
development of, review of, 18: 26931
economics, 18: 26930
feasibility of 300 Mw(e) gas-cooled heavy-water-moderated, economic and technical, 18: 26926 (TID-20605)
fuel elements for French and Euratom, 18: 26902
isotope production in, economic value of, 18: 26927 (TID-20647)
power excursion in SIMEA, description of first fast, 18: 26922(R) (EUR-1810.i(Paper 5))
safety systems for, evaluation of, 18: 26935
safety systems for, survey of components of, 18: 26936
thermionic cells for, development of in-pile, 18: 26933

POWER SUPPLIES
design of field-controlled, for electromagnetics, 18: 25642
development and testing of thermoelectric, 18: 26251(R) (AD-437280)

PRASEODYMIUM
determination in high-purity compounds, spectrographic, 18: 25288
determination using Xylenol Orange, spectrophotometric, 18: 25285
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
magnetic moment of ions of, in crystalline state and in solution, 18: 25350
neutron elastic scattering at 5.0 Mev, angular distribution, 18: 26668
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26668
neutron total cross section at 14 Mev, 18: 26577
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
solvent extraction from nitric acid solutions by TBP, calculated cascade equilibria for, 18: 25624
spectra in thorium oxide at 100°K, nephelauxetic effects on reflection, 18: 25423

PRASEODYMIUM ACETYLACETONATES
stability of, effects of ionic size on, 18: 25389

PRASEODYMIUM AZIDES
thermal decomposition of, differential thermal analysis of, 18: 25446

PRASEODYMIUM CARBONATES
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354

PRASEODYMIUM CHLORIDES
complexes with 1,10-phenanthroline, structure and thermal stability of, 18: 25387

PRASEODYMIUM COMPLEXES
with acetyl-, benzoyl-, and propionylacetonates, stability of, 18: 25389

PRASEODYMIUM NIOBATES
$CaMoO_4–PrNbO_4$, preparation and spectra of, 18: 26017
$CaWO_4–PrNbO_4$, preparation, luminescent properties, and structure of, 18: 26017

PRASEODYMIUM NITRATES
preparation and spectra of tetravalent, 18: 25353
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354

PRASEODYMIUM OXALATES
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354

PRASEODYMIUM PERCHLORATES
thermal decomposition of, differential thermal analysis and thermogravimetric studies on, 18: 25396

PRASEODYMIUM PHOSPHATES
preparation and single crystal growth of ortho-, 18: 25356

PRASEODYMIUM SULFATES
reduction of anhydrous, by carbon monoxide, 18: 25427
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354

PREGNANCY
effects of, on plasma diamine oxidase content in rats and humans, 18: 25086(R) (TID-20636)
radiodiagnosis in women during, problems in, 18: 25239

PRESSURE DROP
in two-phase flow across thick plate restrictions, 18: 25665

PRESSURE VESSELS
cover design for thermocouple connections, 18: 26840(P)
design of two-chamber, 18: 26853(P)
design with forced circulation for ion exchange circuit, 18: 25639 (CISE-99)
development of prestressed concrete, 18: 26946
fatigue strength of large, cyclic testing of, 18: 25680 (TID-20648)
material surveillance program for, at Garigliano Power Station, 18: 26925 (GEAP-4423)
materials development for, effects of environment on, 18: 26096
pressurizer design for, 18: 26954(P)
stress analysis of multicell, 18: 25633 (ERR-AN-336)

PRESSURIZED WATER REACTORS
corrosion and nuclear fission reactions in, 18: 25924
development of Vulcain, Belgian and UF, 18: 26969
fuel element mounting device for, 18: 26961(P)
pressurized design for, 18: 26954(P)

PRESSURIZERS
design for pressurized-water reactors, 18: 26954(P)

PROPANE
performance as proportional counter gas, 18: 25831
yields in gamma radiolysis of squalane at –196 to 350°C, 18: 25551

PROPANE, 1-BROMO-
bromine recoil chemistry in, from bromine-80 isomeric transition, 18: 25596

PROPANE, 2,2-DIMETHYL-
NO_x–dimethylpropane, photolysis and pyrolysis, free radical reactions in, 18: 25329 (TID-20645)
PROPANE, HEPTACHLORO-
exchange between deuterium and hydrogen in methanol–sodium methoxide system, formation of perfluorocarbanions in, 18: 25451
PROPANE, 2-IODO-
pyrolysis of, kinetics of, 18: 25454
PROPANE, 2-METHYL-
yields in gamma radiolysis of squalane at –196 to 350°C, 18: 25551
1,3-PROPANEDIONE, 1,3-DIPHENYL-
complexes with europium, laser properties of, 18: 25445
complexes with europium, fluorescence properties of, 18: 25455
1-PROPANOL
effects on ion exchange of uranium and other elements in system with organic acids, 18: 25305
effects on radioinduced graft polymerization of celluloses on styrene, 18: 25474(T) (AEC-tr-6372(p.83-8))
electric conductivity of anhydrous uranyl nitrate in, 18: 25394
radiolysis of, free radical yields in gamma, 18: 25538
2-PROPANOL
effects on ion exchange of uranium and other elements in system with organic acids, 18: 25305
yields in radiolysis of acetone in aqueous solutions, acidity effects on, 18: 25582
ethylene–2-propanol, formation of amyl alcohol by beta radiation telomerization of, 18: 25511(T) (AEC-tr-6372(p.413-19))
HCl–2-propanol, sorption of thorium and uranium by ion exchange from, 18: 25383
HNO_3–2-propanol–H_2O, ion exchange of rare earths from, 18: 25395
HNO_3–2-propanol–H_2O, lead complexing in, 18: 25384
HNO_3–2-propanol, sorption of thorium and uranium by ion exchange from, 18: 25383
1-PROPANOL, 2-METHYL-
effects on ion exchange of uranium and other elements in system with organic acids, 18: 25305
PROPENE
radioinduced reactions with hydrogen sulfide; mechanism of, 18: 25550
radiolysis of, spectral studies on gamma, 18: 25588
yields in gamma radiolysis of squalane at –196 to 350°C, 18: 25551
PROPENE, 2-METHYL-
radiation effects on ESR spectra of, temperature effects on, 18: 25513(T) (AEC-tr-6372(p.431-5))
radiolysis of, spectral studies on gamma, 18: 25588
PROPENE POLYMERS
radiation effects on reactions with chlorine and sulfur dioxide, 18: 25490(T) (AEC-tr-6372(p.197-205))
radiation effects on reactions with polysulfone–styrene, sulfur dioxide, and sulfuryl and thionyl chlorides in carbon tetrachloride, 18: 25490(T) (AEC-tr-6372(p.197-205))
radioinduced graft polymerization on acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, effects of additives and alpha pre-irradiation on, 18: 25505(T) (AEC-tr-6372(p.363-9))
radioinduced graft polymerization on acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, effects of additives and alpha pre-irradiation on, 18: 25506(T) (AEC-tr-6372(p.371-7))
PROPENEDIOL
radioinduced crosslinking in resin with maleic and phytic acids, hardening in, 18: 25527(T) (AEC-tr-6372(p.533-8))
PROPIONALDEHYDE
radioinduced polymerization of solid, epitaxy in, 18: 25502(T) (AEC-tr-6372(p.323-30))
PROPIONIC ACID
effects on ion exchange of uranium and other elements in system with organic solvents, 18: 25305
PROPORTIONAL DETECTORS
design for use in x-ray fluorescent analysis, 18: 25834
design of 4π, with mutual anticoincidesce, 18: 25843
ionization fluctuations in low-pressure, 18: 25831
review, 18: 25850
PROPULSION
ion, space-charge neutralization in system for, 18: 25646
nuclear, economics of ship, 18: 26992
performance analysis of electrical-chemical hybrid rocket system, 18: 25635
PROPYLAMINE
photolysis, 18: 25552
radiolysis of, gamma, 18: 25552
PROTACTINIUM
spectra of hydrofluoric acid solutions of pentavalent, absorption, 18: 25344
PROTECTIVE CLOTHING
fabrication of sheets with sound proofing, fire resistance, and radiation shielding properties, 18: 25909(P)
PROTECTIVE OINTMENTS
protective effects of, against radiodermatitis, 18: 25192
PROTEINS
biosynthesis by plants, tracer studies of effects of copper on nitrogen uptake for, 18: 25059(T) (OTS-63-11008(p.6-14))
radiation effects on bacterial agglutination by rabbit liver polypeptide, z, 18: 25110
radiation effects on flour, gamma, 18: 25139
radiation effects on metabolism of, in rabbits, 18: 25198
radiation effects on synthesis of, in strain L cells, gamma, 18: 25209
PROTON BEAMS
energy spread of synchrocyclotron, reduction of, 18: 26177
PROTON SHIELDING
design for space vehicles, 18: 26815
PROTON SPECTROMETERS
design of 180° double-focusing, 18: 25841
PROTONS
biological effects, 18: 25095(T) (FTD-TT-63-1046)
biological effects of, from fast neutron reactions, in mice, 18: 25165
charge transfer with rare gases, cross sections for Lyman alpha emission from, 18: 26235
detection from neutron reactions (n,p), emulsion plate camera for, 18: 25866
effects on bird brains, behavior resultant from, 18: 25099
effects on deformation of zinc single crystals, 18: 26090
effects on dislocation distribution and microhardness of lithium fluoride and potassium and sodium chlorides, 18: 26082
effects on germanium and silicon transistors at 40 and 440 Mev, 18: 26091
effects on hydrogen agglomeration and diffusion in beryllium, 18: 26093
electrochemical discharge of, quantum energy distribution and tunnel effects in, 18: 26209
electron-capture cross sections for, in collisions with helium and hydrogen, 18: 26227
electron-capture cross sections for, exact-resonance, 18: 26228
energy spectra from nitrogen-14 (γ,p) reactions at 15.5 to 30.5 Mev, 18: 26633
form factors, 18: 26312
intensity variations in outer radiation belt, 18: 26444
interactions with mesons (μ^-), 18: 26525 (BNL-837(p.315-23))
interactions with hyperons (Λ), ${}_{\Lambda}H^3$ lifetime from, 18: 26527 (BNL-837 (p.454-6))
interactions with mesons (μ^-) in mu-mesic hydrogen molecular ions, 18: 26555(R) (ORNL-3582(p.130))
interactions with antineutrinos, form factors in, 18: 26268 (BNL-837 (p.249-56))
interactions with mesons (μ^-), 18: 26271 (BNL-837(p.277-91))
interactions with photons, meson (π^+) production in, 18: 26282
interactions with neutrons, potentials for, 18: 26285
interactions with antiprotons meson (ρ) production in, 18: 26286
interactions with mesons (K^+) near ½-⅓ resonance, effective cross section for, 18: 26288
interactions with electrons, meson (π) production in, 18: 26312
interactions with mesons (K^-) at 1.51 to 1.70 Bev/c, Y_1^* resonances in, 18: 26328
interactions with mesons (K^-) at 1.8 Bev/c, charge exchange in, 18: 26339
interactions with mesons (K^-), Y_1^* parity and spin from, 18: 26340
interactions with mesons (K^-) and (π^+), hyperons (Σ^+) and (Ξ^-) parity and spin from, 18: 26343

interactions with mesons (μ^-), capture rate in (p,μp), 18: 26345
interactions with mesons (π^-) at 1.5 to 4.2 Bev, π-p enhancement in, 18: 26346
interactions with hyperons (Λ), elastic-scattering cross sections in, 18: 26347
interactions with mesons (π^-), model for inelastic, 18: 26351
interactions with mesons (π^-) at 829 Mev, resonance effects in, 18: 26352
interactions with photons, 2π mass spectra in, 18: 26353
interactions with antiprotons at high energies, anti-shrinkage in diffraction, 18: 26365
interactions with neutrons at 1.6 Bev/c in bubble chamber, pion production by, 18: 26376
interactions with mesons (π^-) at 310 and 377 Mev, cross sections for ($\pi^- + \pi^0 + p$) production in, 18: 26377
interactions with mesons (K^+) at 910 Mev/c, production of ($K^0 + p + \pi^+$) by, 18: 26381
mass difference between neutrons and, dispersion calculations of, 18: 26374
production in molecular hydrogen ion dissociation, 18: 26207
reactions (p,α) with bismuth at 155 Mev, 18: 26629
reactions (p,α_0) at 2.0 to 3.3 Mev with fluorine-19, angular distributions, and cross sections for, 18: 26664
reactions (p,γ) with silicon-28 at 1.3 to 3.2 Mev, 18: 26593
reactions (p,γ) with silicon-30, phosphorus-31 spin-parity from, 18: 26635
reactions (p,γ) with aluminum-27 18: 26661
reactions (p,He-3) and (p,t) with oxygen-16 at 43.7 Mev, 18: 26653
reactions (p,n) and (γ,2n) with bismuth-209, polonium-210 production in, 18: 26647
reactions (p,n) at 4 to 14 Mev, 18: 26601
reactions (p,n) with nuclei, CVC theory in, 18: 26526 (BNL-837(p.340-3))
reactions (p,n) with tritium, threshold energy for, 18: 26616
reactions (p,n) with tenuous gases, resonances in, 18: 26672
reactions (p,n), (p,2n), (p,3n), and (p,4n) with dysprosium isotopes at 9 to 87 Mev, cross sections for, 18: 26584
reactions (p,pd) with nuclei, wave functions for, 18: 26643
reactions (p,2p) with light nuclei at 185 Mev, 18: 26567
reactions in thick iron targets at 1 to 3 Bev, radioisotope production in, 18: 26583
reactions with beryllium at 25 Bev, meson yields from, 18: 26165 (BNL-837(p.91-113))
reactions with bismuth, astatine isotope production in, 18: 26602
reactions with helium-4 at 31 Mev, 18: 26604
reactions with lead, astatine isotope production in, 18: 26602
reactions with silver at 2.9 Bev, ranges of recoil products from, 18: 26648
scattering by aluminum-27 at 4.4 and 5.06 Mev, inelastic, 18: 26613
scattering by boron-11 at 150 Mev, inelastic, 18: 26614
scattering by chromium-50, inelastic, 18: 26619
scattering by helium-4 at 31 Mev, elastic, 18: 26604
scattering by holmium-165 at 17.5 Mev, 18: 26537(R) (ORNL-3582(p.55))
scattering by nickel-62 at 17.5 Mev, 18: 26536(R) (ORNL-3582(p.54))
scattering by nitrogen-14 at 9.15 to 10.45 Mev, energy level excitation in inelastic, 18: 26605
scattering by zinc at 5.8 Mev, gamma-proton angular correlations in inelastic, 18: 26582
scattering of, computer program for angular distributions and cross sections for compound-nuclear-state, 18: 26556 (ORNL-TM-875)
scattering on nuclei at 180 Mev, strong absorption model for elastic, 18: 26562
spectra in earth's radiation belt, 18: 26244

PSEUDOUREA, 2-(2-AMINOETHYL)-2-THIO-
protective effects against genetic effects of x radiation on rats, 18: 25215(T) (AEC-tr-6227/1(p.25-44))

PSYCHOLOGY
disaster reactions and treatment of, 18: 25731
of dogs, field studies of, 18: 25091(R) (UCD-472-109(p.49-52))

PULSE ANALYZERS
analog-to-digital converter for, fast binary, 18: 25807 (NAS-NRC-Pub-1184(p.172-6))
analog-to-digital converter for, performance of, 18: 25808 (NAS-NRC-Pub-1184(p.177-9))
analog-to-digital converter using comparators for, 18: 25809 (NAS-NRC-Pub-1184(p.180-3))
analog-to-digital conversion for, causes of inaccuracy in, 18: 25811 (NAS-NRC-Pub-1184(p.186-94))
circuitry for, time-discriminator antiwalk, 18: 25795 (NAS-NRC-Pub-1184 (p.112-16))
computers for, description of PDP-5, 18: 25881 (NAS-NRC-Pub-1184 (p.266-8))
conference on instrumentation techniques in nuclear pulse analysis, 18: 25781 (NAS-NRC-Pub-1184)
description of multidimensional kicksorter using magnetic tape storage, 18: 25824 (NAS-NRC-Pub-1184(p.305-12))
design and performance of multiparameter system at LRL in Berkeley, 18: 25823 (NAS-NRC-Pub-1184(p.287-91))
design considerations for multiparameter analysis system for data collection and processing, 18: 25820 (NAS-NRC-Pub-1184(p.239-46))
design of amplitude discriminator using semiconductor elements, 18: 25767(P)
design of fast, 18: 25810 (NAS-NRC-Pub-1184(p.184-5))
design of Iowa four-parameter system, 18: 25822 (NAS-NRC-Pub-1184 (p.283-6))
design of modular components for, compatibility in, 18: 25814 (NAS-NRC-Pub-1184(p.210-11))
design of stored program radiation analyzers, 18: 25821 (NAS-NRC-Pub-1184(p.255-65))
design of tunnel-diode discriminator, 18: 25774(P)
development at BNL, 18: 25743 (NAS-NRC-Pub-1184(p.36-7))
development of transistorized circuit modules for, 18: 25792 (NAS-NRC-Pub-1184(p.79-88))
development of ultrahigh-speed analyzer-computer system, 18: 25818 (NAS-NRC-Pub-1184(p.229-36))
development of 16-channel transistorized fast, for high-energy experiments, 18: 25805 (NAS-NRC-Pub-1184(p.165-8))
discriminators for, performance of NPN transistors in synchronized, 18: 25796 (NAS-NRC-Pub-1184(p.117-18))
display for, proposed use of storage tubes for, 18: 25826 (NAS-NRC-Pub-1184(p.322-3))
oscilloscope displays for, digital interrogator for, 18: 25825 (NAS-NRC-Pub-1184(p.313-19))
pulse-shape discrimination systems for, using pulse cross-over, 18: 25802 (NAS-NRC-Pub-1184(p.143-5))
pulse-shape discriminator for neutron time-of-flight, zero cross-over, 18: 25803 (NAS-NRC-Pub-1184(p.146-9))
review of CERN, 18: 25783 (NAS-NRC-Pub-1184(p.18-22))
review of Harwell, 18: 25782 (NAS-NRC-Pub-1184(p.15-17))
spectrum stabilization for, digital methods for, 18: 25804 (NAS-NPC-Pub-1184(p.150-64))
survey of ORNL, 18: 25745 (NAS-NRC-Pub-1184(p.40-1))
testing of linearity of, design of pulse generator for, 18: 25816 (NAS-NRC-Pub-1184(p.216-19))
testing of, random-pulse generator for, 18: 25815 (NAS-NRC-Pub-1184 (p.212-15))
use for measurement of transfer functions by cross-correlation, 18: 25813 (NAS-NRC-Pub-1184(p.207-9))
use in multiparameter experiments, modifications for, 18: 25819 (NAS-NRC-Pub-1184(p.237-8))

PULSE GENERATORS (ELECTRONICS)
design of "ramp-pulser" for testing linearity of pulse analyzers, 18: 25816 (NAS-NRC-Pub-1184(p.216-19))
use of avalanche diodes for random, 18: 25815 (NAS-NRC-Pub-1184 (p.212-15))

PULSE MODIFIERS
design of multiplier circuits using logarithmic diodes, 18: 25801 (NAS-NRC-Pub-1184(p.140-2))
linearity of pulse height-to-time converters, method for improving low-level, 18: 25806 (NAS-NRC-Pub-1184(p.169-71))
uses of antiwalk discriminators in pulse-height analyses, 18: 25795 (NAS-NRC-Pub-1184(p.112-16))

PUMPS
design, 18: 25648

PUREX PROCESS

waste processing for rare earth and strontium separation, 18: 25606 (ORNL-3585)
3,5-PYRAZOLIDINEDIONE, 4-BUTYL-1,2-DIPHENYL-
protective effects against radiation injury, 18: 25243
PYRAZOLONES
1-phenyl-3-methyl-4-acetyl-, solvent properties for americium and europium, 18: 25622
PYRIDINE
radioinduced crosslinking reactions with epoxy resin, hardening in, 18: 25528(T) (AEC-tr-6372(p.539-46))
PYRIDINE, 2-METHYL-5-VINYL-
radioinduced graft polymerization to polypropene, effects of additives and alpha pre-irradiation on, 18: 25505(T) (AEC-tr-6372(p.363-9))
radioinduced graft polymerization on polypropene, effects of additives and alpha pre-irradiation on, 18: 25506(T) (AEC-tr-6372(p.371-7))
PYROCATECHOL
deuterium–hydrogen exchange in alkaline solution of, 18: 25453
4-PYRONE
2-chloromethyl-5-hydroxyl-, solvent properties for americium and europium, 18: 25622
4-PYRONE, 5-HYDROXY-2-(HYDROXYMETHYL)-
solvent properties for americium and europium, 18: 25622

Q

QUANTUM ELECTRODYNAMICS
boson-photon interactions in, Feynman diagrams for, 18: 26419
cross section relations for testing, 18: 26564
electric charges in, fluid theory of, 18: 26416
formalism of, generalization of, 18: 26409
formulation of, without using indefinite metric, 18: 26428
renormalization in stochastic theory, 18: 26437
stimulated emission of radiation in, 18: 26399
wave operators in, convergent perturbation expansions for, 18: 26401
QUANTUM MECHANICS
book: *Group Theory and Quantum Mechanics*, 18: 26438
boson mixtures, application of Bogoliubov transformation to, 18: 26436
electron kinetics in periodic systems in, equations for, 18: 26405
energy and time indeterminacy in, 18: 26418
formalism for free fields in, 18: 26402
metrology in, time symmetry in, 18: 26417
oscillators in, quantization procedures for, 18: 26400
path integrals in Feynman representation of, functional, 18: 26427
perturbation theory for three-particle system, 18: 26432
potentials for one-variable Schroedinger equation, soluable, 18: 26412
relaxation of optical lattice vibrations in, 18: 26130
space quantization in relativistic, 18: 26387(R) (ORNL-3582(p.41-5))
time measurement in, theory of hermitian operator for, 18: 26433
wave equations for heterogeneous layers, 18: 26434
wave equations for nonlocal solvable interactions in, Schroedinger, 18: 26404
wave function for two electron–proton system, 18: 26203 (NASA-TN-D-2145)
Wick's theorem in, 18: 26398
QUARTZ
sorption of calcium and sodium on, measurements by ion-exchange membrane electrodes, 18: 25327 (RT/GEO(64)-1)
QUATERPHENYL
radioinduced polarization of fluorescence from, 18: 25594
scintillation properties in liquid helium, 18: 25849
8-QUINOLINOL, 5,7-DICHLORO-
solvent properties for americium and europium, 18: 25622

R

RABBITS
distribution of phosphorus-32-labeled colloid in tissues of, 18: 25075
radiation effects on bacterial agglutination by liver polypeptides in, x, 18: 25110
radiation effects on tissue cultures from, as affected by cell biochemistry and morphology, 18: 25117
radiation effects on nervous system in, exposed *in utero*, 18: 25121
radiation effects on amino acid metabolism in, 18: 25198
radiation effects on, protective effects of polysaccharides against, x, 18: 25218
radiation effects on, protective effects of gelatin and serum on leptospirosis antibody formation in, 18: 25228
radiation effects on blood picture in normal and starch-injected parabiotic, 18: 25150
radiation sickness effects on deferred treatment of firearm wounds in, 18: 25202
radioinduced cataracts in, x, 18: 25195
therapy of eye inflammation in, using thallium-204 beta source, 18: 25097(T) (JPRS-24936)
RADIATION
attenuation of two-component substances, changes in unequal coefficients of mass, 18: 26573
belts of, produced by Soviet 1962 high-altitude thermonuclear explosions, 18: 26188 (SUI-63-37)
biological effects of, from atomic explosion, 18: 25722
biological effects of, in man, 18: 25247
biological effects, 18: 25105
biological effects on human skin, 18: 25080 (AHSB(RP)R-39(p.11-19))
biological effects on skin, 18: 25081 (AHSB(RP)R-39(p.21-9))
book: *Nuclear Energy*, 18: 26241
book: *Nuclear Radiation Detection*, 18: 25850
carcinogenic effects of, review, 18: 25211
carcinogenic effects on skin, 18: 25081 (AHSB(RP)R-39(p.21-9))
catalytic effects on chemical reactions, industrial applications of, 18: 25872
criteria for selection of personnel for work with, 18: 25716
cytological effects on liver, 18: 25141
determination of air gamma dose rate in U. S., 1962 and 1963, 18: 25694
dosage determinations of, in gastrointestinal tract of ruminants after ingestion of insoluble radioisotopes, 18: 25142
doses to cell nuclei from tritiated thymidine uptake by mouse testes, 18: 25069
doses to nursing personnel in radium wards, 18: 25719
doses, estimation of, after accidents, 18: 25144
dosimetry of personnel exposed occupationally, 18: 25717
dosimetry of, in skin, from external exposure, 18: 25082 (AHSB(RP)R-39(p.31-43))
effects on bismuth, annealing of defects produced in, 18: 26094
effects on DNA content of tissue of rats, 18: 25137
effects on dogs, delayed, 18: 25089(R) (UCD-472-109(p.18-44))
effects on doublet quintet ESR spectra of polytetrafluoroethylene, 18: 25530(T) (AEC-tr-6372(p.555-62))
effects on enzyme activity in blood and liver of rats, 18: 25154
effects on ESR spectra of polyoxymethylene and trioxane, comparison of, 18: 25516(T) (AEC-tr-6372(p.455-8))
effects on ESR spectra of acrylamide, temperature effects on, 18: 25517(T) (AEC-tr-6372(p.459-64))
effects on eyes and skin, 18: 25146
effects on human blood picture, 18: 25174
effects on insulation materials, review on, 18: 26077
effects on mice, protective effects of olive oil against, 18: 25231
effects on ovarian function in women, 18: 25196
effects on rabbits, protective effects of gelatin and serum on leptospirosis antibody formation in, 18: 25228
effects on thorium dioxide–uranium dioxide fuel particles, electron microscopic studies on, 18: 26081
emission by charges in motion, 18: 26296
emission by relativistic particles in laminated media, 18: 26297
genetic effects on salivary gland chromosomes of *Chironomus tentans* larvae, 18: 25212
graft polymerization of celluloses on styrene induced by, solvent effects on, 18: 25474(T) (AEC-tr-6372(p.83-8))
graft polymerization of cellulose on butadiene–styrene system induced by, rate of, 18: 25478(T) (AEC-tr-6372(p.109-15))
graft polymerization of celluloses on acrylonitrile–butadiene and butadiene–styrene, structural effects on, 18: 25481(T) (AEC-tr-6372(p.129-34))
hazards in radium wards, 18: 25719
hazards to infants and young children, 18: 25727

induction of carcinomas by low doses of, review, 18: 25149
leukemia induction by exposure to, in man, 18: 25193
leukemogenic effects of, in man, 18: 25241
maximum permissible dose of, for skin, 18: 25082 (AHSB(RP)R-39(p.31-43))
medical applications of, 18: 25246
mutagenic effects on rye seeds, 18: 25126
pathological effects of, in man, 18: 25194
polymerization of formaldehyde with acrylonitrile, methyl methacrylate, and styrenes induced by, kinetics of, 18: 25492(T) (AEC-tr-6372 (p.213-22))
polymerization of oxetane and β-propiolactone derivatives, 18: 25497(T) (AEC-tr-6372(p.273-86))
polymerization of benzaldehyde, oxetanes, β-propiolactone, silicones, styrenes, toluenes, and trioxane induced by, rate of, 18: 25503(T) (AEC-tr-6372(p.331-47))
polymerization of monoamines with epoxy resins induced by, hardening in, 18: 25528(T) (AEC-tr-6372(p.539-46))
reduction of doses of, review, 18: 25046
uses in ionization analysis of gases, 18: 25290
variation in intensity of, method for measuring, 18: 25051
whole-body exposure to, physical aspects of, 18: 25145

RADIATION CHEMISTRY
developments in, review on, 18: 25540
of acetone in aqueous solutions, acidity effects and yields in, 18: 25582
of α- and p-toluenethiol, solvent effects on, 18: 25549
of ammonia, hydrazine, and hydroxylamine in aqueous solutions, mechanisms and reaction rates in, 18: 25583
of aqueous glycine, yields in, 18: 25584
of aqueous media, conference on basic mechanisms in, 18: 25575
of aqueous solutions, kinetics of pulsed electron beam, 18: 25578
of aqueous solutions, effects of acidity and oxygen on, 18: 25580
of benzene–cyclohexane, energy transfer in, 18: 25544
of benzene–ethanol, yields in, 18: 25545
of cystamine, formation of cysteamine in, 18: 25542
of free radical addition to carbon-carbon bonds, 18: 25466 (AERE-R-4587)
of liquid ethanol, mechanism of hydrogen formation in, 18: 25589
of low molecular weight compounds, 18: 25525(T) (AEC-tr-6372(p.503-10))
of n-alcohols, free radical yields in, 18: 25538
of olefins and iodomethane in olefin glasses, spectral studies on, 18: 25588
of single-carbon compounds in aqueous solutions, reactions of hydrated electron in, 18: 25579
of squalane at –196 to 350°C, yields in, 18: 25551
of sulfur–toluene solutions, formation of sulfur compounds in, 18: 25547
of water, formation and detection of intermediates in, 18: 25576
radiation applications as catalyst in industrial processes, 18: 25872
radiolysis of aqueous solutions, review of, 18: 25590
research on polymers, annual report of Japanese Association for, Vol. III, 18: 25470(T) (AEC-tr-6372)
source for, design of, 18: 25601(P)

RADIATION DAMAGE
many-body approach to crystalline, computer program for, 18: 26070 (BNL-7979)

RADIATION DETECTION INSTRUMENTS
care and maintenance of, 18: 25862
design, 18: 25835
design and construction, 18: 25832
design of glow tube indicator with calibration means, 18: 25854(P)
design using fluorescence for low-level dosimetry, 18: 25855(P)
review, 18: 25850

RADIATION DETECTION INSTRUMENTS (PULSE TYPE)
design for low-energy beta particles, 18: 25853(P)
design of array of 100 scintillation counters for representation of motion of gamma sources, 18: 25851
design of stored program radiation analyzers, 18: 25821 (NAS-NRC-Pub-1184(p.255-65))
pulse-shape discrimination systems for, using pulse cross-over techniques, 18: 25802 (NAS-NRC-Pub-1184(p.143-5))
scanning device with demountable collimator for radiodiagnosis, 18: 25258(P)
use for thin film thickness measurements, 18: 25769(P)

RADIATION DETECTORS
book: *Nuclear Radiation Detection*, 18: 25850
design of gas-flow counter, 18: 25859(P)
development of, for x-ray beam dosimetry, 18: 25838
evaluation of, for use in skin dosimetry, 18: 25082 (AHSB(RP)R-39 (p.31-43))
review on semiconductor, 18: 25848
use in M60 tank for gamma radiation survey, optimum position for, 18: 25709 (NDL-TR-49)

RADIATION EFFECTS
on biological membranes, 18: 25106

RADIATION EXPOSURE CHAMBERS
design of vault, 18: 25600(P)

RADIATION INJURIES
conference on, 18: 25144
diagnosis, symptomatology, and treatment of, 18: 25227
in rats, effects of physical exertion on, 18: 25199
in rats, effects of jaw injury on, 18: 25199
in yeast, protective effects of p-chloromercuribenzoate against, 18: 25224
lethal, in chicken corneal cells, 18: 25169
multi-hit and multi-target theories for, in biological systems, 18: 25170
of fetuses during diagnostic radiography of mothers, 18: 25151
of heart, effects on electrocardiograms in rabbits, 18: 25109
of human skin, repair of, 18: 25080 (AHSB(RP)R-39(p.11-19))
of mammalian cells, multi-hit and multi-target survival curves for calculation of, 18: 25171
of skin, 18: 25214 (AHSB(RP)R-39(p.87-93))
protection against, effects of injected lipids on, in mice, 18: 25217
resulting from use of radioisotopes in medicine, 18: 25194
surgical repair of radium-induced fistula, 18: 25232

RADIATION PROTECTION
concentrations of radioisotopes in air, water, and soil, international standards for maximum permissible, 18: 25733
during diagnostic and therapeutic radiography procedures, 18: 25241
during diagnostic radiographic procedures, 18: 25247
during medical applications of radium, 18: 25734
effects of parabiosis on auditory organs of embryonic salamanders, 18: 25148
in industrial uses of radioactive tracers, 18: 25725
of eyes during nuclear explosions and space travel, 18: 25044
of operator during fluoroscopic examinations, 18: 25249
of radiology department personnel, 18: 25721
survey on, in U. S., 18: 25248

RADIATION SICKNESS
bibliography on, 18: 25153
diagnosis of chronic, in man, 18: 25153
effects on ascorbic acid content in brain tissue of dogs, 18: 25161
effects on firearm wounds on rabbits, 18: 25202
protective effects of sterilized organolysates against, in rats, 18: 25219
protective effects of screening abdomen, chest, or head against, in rats, 18: 25225
protective effects of anti-leptospirosis vaccine and serum against, in rabbits, 18: 25228

RADIATION SOURCES
shielding of disc, 18: 26818
use in radiation chemistry studies, 18: 25525(T) (AEC-tr-6372(p.503-10))

RADIATION TARGET CANS
design and construction of, for reactor irradiation of organic liquids, 18: 25543
design for neutron auto-radiography of encapsulated irradiated fuels, 18: 26068 (ANL-6799)
development for reactor fuel studies, 18: 26897(R) (ANL-6868(p.175-87))
welding techniques for, argon-arc, 18: 25948

RADIATION TARGETS
design of cryogenic chamber, for charged particle reactions, 18: 26672
preparation of isotopic, at ORNL, 18: 25877 (ORNL-3400)

RADIO WAVES
absorption by expanding hydrogen cloud, profiles for, 18: 26194

absorption in ionospheric auroral regions, variations in, 18: 26451
absorption near poles, solar alpha particle effects on, 18: 26445
current-jet hypothesis of whistler generation, validity of, 18: 26450
propagation at 834 kcps, effects of nuclear explosions on ionospheric, 18: 26454
propagation from satellites, effects of atomic explosions on, 18: 26100
propagation of v-l-f, effect of atmospheric radioactivity on, 18: 26099
sources in space, properties of extended, 18: 26190

RADIOACTIVE CONTAMINATION
of skin, countermeasures for, 18: 25213 (AHSB(RP)R-39(p.69-77))
of skin, mechanisms of permeation in, 18: 25056 (AHSB(RP)R-39(p.79-86))

RADIOACTIVE MATERIALS
leakage from waste storage tanks, thermal consequences of, 18: 26976 (HW-80848)
monitoring in air, evaluation of filters for, 18: 26098 (NRL-6054)
photography of, equipment and methods in, 18: 26991
radiation dose to gastrointestinal tract of ruminants from ingestion of insoluble, 18: 25142
shipping of, bibliography on, 18: 25713 (VDDIT-89)

RADIOACTIVITY
atmospheric, from nuclear explosions, 18: 26099
book: *Nuclear Energy*, 18: 26241
decontamination of liquors by ion exchange using basic lead sulfate, 18: 25262(P)

RADIOBIOLOGY
research progress in, Boris Kidric Institute of Nuclear Sciences, Belgrade, Yugoslavia, 18: 26989(T) (AEC-tr-6227/1)

RADIOCHEMICAL PROCESSING PLANTS
dissolver for, material selection for, 18: 25996

RADIOCHEMISTRY
research progress in, Boris Kidric Institute of Nuclear Sciences, Belgrade, Yugoslavia, 18: 26989(T) (AEC-tr-6227/1)

RADIODERMATITIS
protection against, effects of protective ointments on, 18: 25192
therapy, 18: 25214 (AHSB(RP)R-39(p.87-93))

RADIODIAGNOSIS
book: *Results of Medical Radiation Research*. Volume 1, 18: 25256
development of body scanning techniques, 18: 25257
hazards to children, 18: 25046
leukemogenic effects during pregnancy, 18: 25152
of thyroid diseases, effects of thyroidal iodine-131 uptake rate on, 18: 25237
problems in, in women of childbearing age and pregnant, 18: 25239
radiation hazards to patients from, 18: 25194
scanning device design for, with demountable collimator, 18: 25258(P)
scintillation camera for brain, kidney, liver, and thyroid tumor, development of, 18: 25236

RADIOGRAPHY
control of physical standards for, 18: 25248
diagnostic, effects of radiation on leukocyte chromosomes in, 18: 25163
diagnostic, measurements of scattered x radiation during, 18: 25255
diagnostic, radiation hazards from, 18: 25241
diagnostic, radiation protection during, 18: 25247
equipment and methods of neutron imaging, 18: 25675(R) (ANL-6868 (p.219-28))
medical, developments in, 18: 25246
of pregnant women, effects on infant mortality, 18: 25151
therapeutic, radiation hazards from, 18: 25241
use of strontium lactate as contrast medium for, 18: 25242
use of Van de Graaff for industrial, 18: 26175

RADIOISOTOPES
book: *Nuclear Energy*, 18: 26241
concentrations in air, water, and soil, international standards for maximum permissible, 18: 25733
detection and measurement in solutions using scintillating organic anion exchange resin, 18: 25259 (NYO-10405)
half-life measurements for short-lived, development of transistorized time analyzer for, 18: 25753
industrial uses of, radiation protection in, 18: 25725
preparation and chemical processing of, ORNL Manual for, 18: 25607 (ORNL-3633)
processing of, possibilities and consequences of accidents in, 18: 25711 (ORNL-3441)
scintillation detection of injected, method for, 18: 25051
separation from reactor effluent water by flocculation, 18: 26861(P)
uses in geology and hydrology studies, 18: 25699(T) (OTS-63-11008 (p.15-21))
uses in materials testing, 18: 26992
uses in preparation of semiconductor devices, 18: 25846
uses in research, selected translations from Russian on, 18: 25868(T) (OTS-63-11008)
uses in thin-layer ionophoresis for separating inorganic materials, 18: 25612(T) (ORNL-tr-128)

RADIOLOGICAL WARFARE
effects on farm animals, 18: 25732

RADIOLOGY
book: *Results of Medical Radiation Research*. Volume 1, 18: 25256
diagnostic, dosimetry of stray radiation during, 18: 25721

RADIOMETRIC ANALYSIS
effects of Degranol on desoxyribonucleic acid synthesis in bone marrow and tumor cells in rats and mice, 18: 25173

RADIOMIMETIC SUBSTANCES
effects of Degranol on desoxyribonucleic acid synthesis in bone marrow and tumor cells in rats and mice, 18: 25166
effects on enzyme activity in blood and liver of rats, 18: 25154

RADIOPROTECTIVE COMPOUNDS
test system for, using radiosensitivity of splenomegaly induced by Friend leukemia virus in mice, 18: 25223

RADIOSENSITIVITY
of castorbean seeds, 18: 25180
of Drosophila embryos, 18: 25143
of HeLa cells in culture, effects of dose rate on, 18: 25187
of mouse skin, 18: 25081 (AHSB(RP)R-39(p.21-9))
of onion seeds, effects of age on, 18: 25179
of rats, effects of repeated sublethal doses of x radiation on, 18: 25127
of roots, effects of catalase activity and gibberellic acid on, 18: 25183
of skin, effects of radiation source and dose fractionation on, 18: 25192
of tobacco mosaic virus and infectious nucleic acid portion of virus, 18: 25159
temperature effects on, of chicken heart cells in tissue culture, 18: 25204

RADIOSTERILIZATION
of flour, free radical induction by, 18: 25123

RADIOTHERAPY
book: *Results of Medical Radiation Research*. Volume 1, 18: 25256
for breast and uterine tumors, effects on gonadal iodine-131 distribution, 18: 25120
measurement of integral absorbed dose in a body exposed to gamma source, 18: 25245
of ankylosing spondylitis, effects on lymphocyte chromosomes, 18: 25158
of cancer of urinary bladder, results of massive doses of gamma radiation in, 18: 25244
of carcinoma of lung, sequelae of, alone and combined with surgery, 18: 25252
of carcinomas, protective effects of phenylbutazone during, 18: 25243
of cervical carcinoma with radium implant, effects of halothane anesthesia on liver during, 18: 25118
of cervical carcinomas, complications after, radium and x, 18: 25167
of Hodgkin's disease, time-dose relations for, 18: 25251
of laryngeal carcinoma, dose-time relations for, 18: 25250
of lung cancers, 18: 25240
of lung tumors, comparison of radiation dose delivered to mediastinum at 9 centers, 18: 25253
of malignant tumors in man using gamma unit, 18: 25254
of tumors, effects of autologous bone marrow transfusions on results of, 18: 25220
radiation hazards to patients from, 18: 25194
using radium, hazards from, 18: 25719
with radium and cobalt-60 sources, effects on ovarian function in women, 18: 25196

RADIUM
content in marine rocks in Israel, 18: 25686
content in underground waters of Egyptian oil fields, 18: 25696
effects on liver after uterine carcinoma therapy, effects of halothane on,

18: 25119
pathological effects of, surgical repair of fistula, 18: 25232
radiation protection during medical applications of, 18: 25734
therapy of cervical carcinomas using, complications after, 18: 25167
RADIUM ISOTOPES Ra-226
contribution to gamma radioactivity of earth, 18: 25694
RADON
decay, intensity of soft beta rays in air at sea level produced by, 18: 26102
RADON ISOTOPES Rn-221
separation of lead-213 from, 18: 25869
RAIN WATER
radioactivity, 18: 25692
RARE EARTH ALLOYS
crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Fe–Pd–rare earth, magnetic moment alignment in dilute, 18: 25977(R) (ORNL-3582(p.2-4))
RARE EARTH BORIDES
phase studies, 18: 25319 (COO-1140-103)
reactions with carbon, tantalum, tungsten, and zirconium, 18: 25319 (COO-1140-103)
vaporization, decomposition pressures, and stability, 18: 25319 (COO-1140-103)
RARE EARTH COMPLEXES
with isobutyrate, α-hydroxyisobutyrate, and α,β,β′-trihydroxyisobutyrate, formation constants, 18: 25260
RARE-EARTH GERMANIUM MOLYBDATES
preparation, crystal structure, and magnetic and optical properties, 18: 25317 (CONF-405-31)
RARE EARTH OXYFLUORIDES
preparation by heating fluorides in air, 18: 25318 (CONF-405-39)
RARE EARTH PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
RARE EARTH PHOSPHATES
preparation and single crystal growth of ortho-, 18: 25356
RARE EARTH SYSTEMS
B–C–rare earths, phase studies, 18: 25319 (COO-1140-103)
RARE EARTH THIOCYANATES
with 1,10-phenanthroline, structure and thermal stability of, 18: 25387
RARE EARTHS
separation by ion exchange using basic lead sulfate, 18: 25262(P)
separation from Purex wastes by ion exchange, 18: 25606 (ORNL-3585)
separation from scandium by cation exchange chromatography, 18: 25613
thermodynamic properties, 18: 26062
vapor pressures at 10^{-1} to 10^{-3} mm Hg, 18: 26062
RARE GAS COMPOUNDS
preparation and structure of, review on, 18: 25401
RARE GASES
chemical properties and structure of, review on, 18: 25401
properties of solidified, review on, 18: 25348
spectra in lasers, emission, 18: 26114(R) (ORNL-3582(p.36-7))
stability of solid, atomic-multipole interactions in, 18: 26223
RATE METERS
design of photovoltaic cell, 18: 25867
use for intercomparisons of dose, at radiotherapy centers, 18: 25253
RATS
buffer distribution in isolated perfused rat heart, tracer study, 18: 25041
deposition of iodine-131-labeled fibrinogen in thyroid, liver, and tumors in, 18: 25068
pathological effects of injected Thorotrast in, 18: 25065
radiation effects on stress accommodation in, neutron and x, 18: 25100
radiation effects on mitosis in, x, 18: 25101
radiation effects on skin homograft survival in, beta, 18: 25112
radiation effects on homologous skin grafts in, x, 18: 25114
radiation effects on polysaccharide phosphorylase activity in, x, 18: 25115
radiation effects on DNA level in lymphocytes of spleen, 18: 25137
radiation effects on development of transplanted tumors in, 18: 25197
radiation effects on audiogenic seizure in, gamma, 18: 25206
radiation effects on reproductive ability of males and malformations in first generation, x, 18: 25215(T) (AEC-tr-6227/1(p.25-44))
radiation effects on survival of, protective effects of abdomen, chest, and head screening against, 18: 25225
radiation effects on desoxyribonucleic acid of spleen of, 18: 25084 (NYO-2568-1)
radiation effects on enzyme activity in, 18: 25086(R) (TID-20636)
radiation effects on blood serum protein content in, 18: 25140
radiation effects on enzyme activity in blood and liver of, 18: 25154
radiation effects on water circulation in gastrointestinal tract in, 18: 25155
radiation effects on erythropoiesis in, ultraviolet, 18: 25160
radiation effects on nucleic acid synthesis in bone marrow of, synergistic effects of radiomimetic compound on, 18: 25166
radiation effects on gastric passage time in, 18: 25172
radiation effects on nucleic acid synthesis in bone marrow of, synergistic effects of radiomimetic compound on, 18: 25173
radiation injuries in, effects of jaw injury and physical stresses on, 18: 25199
radiation sickness in, protective effects of sterilized organolysates against, 18: 25219
radioresistance and radioexcitability of, effects of repeated sublethal irradiations on, 18: 25127
tumors induced by strontium and silica implants in, 18: 25053
REACTION MECHANISMS
radiation effects on, industrial applications of, 18: 25872
transmethylation kinetics in biological systems, 18: 25061
REACTOR CONTROL ELEMENTS
fabrication of neutron-absorbing tubes, 18: 25956(P)
REACTOR CONTROL RODS
design with releasable drive, 18: 26849(P)
development, 18: 26896(R) (ANL-6868(p.133-74))
development and testing, 18: 26897(R) (ANL-6868(p.175-87))
digital position indicator design for, 18: 26834
drive for, design of electrohydraulic, 18: 26851(P)
drive mechanism design for, 18: 26850(P)
drive motors, circuit for selective operation of stepping, 18: 25654(P)
efficiency of multiple, partially inserted in reflected reactor, 18: 26833
neutron absorption by multilayer, calculation of effective boundary conditions for, 18: 26831
neutron absorption by moderator-containing, calculation of effectiveness of, 18: 26832
reactivity worths in Halden Boiling Reactor, 18: 26948
worth determinations for CVTR two-region lattice, 18: 26863 (CVNA-134)
REACTOR CONTROL SYSTEMS
cables for in-pile pulse counting, properties of insulation for, 18: 26830 (AEEW-M-369)
design for power reactors, 18: 26935
design for uniform changes in neutron flux, 18: 26845(P)
design of electrohydraulic drive for, 18: 26851(P)
design of servo-controlled rod regulator, 18: 26856(P)
development for external minimization of BWR noise, 18: 26924(R) (EURAEC-1065)
electronic instrumentation for BR-1, 18: 26964
shutdown device using balls for gas-cooled reactors, 18: 26858(P)
shutdown of heavy-water reactor by sudden change in reactivity, residual power calculations for, 18: 26864 (EUR-548.f)
REACTOR COOLANTS
pressure transients of, during fast-reactor excursions, 18: 26824(R) (ANL-6885)
separation of radioisotopes from, by flocculation, 18: 26861(P)
REACTOR COOLING SYSTEMS
fission product detection in gas-cooled, monitoring device for, 18: 26859(P)
fission-product deposition from gas streams in, heat/mass analogy for, 18: 26939
use of mercury–steam binary power cycle in, 18: 26949
use of sodium in, review on, 18: 26829
REACTOR ENGINEERING
conference on exponential and critical experiments, 18: 26873
conference on exponential and critical experiments, 18: 26881
design philosophy of General Electric, 18: 26826
planning of research with a reactor, 18: 26966
relation between experiment and theory in reactor physics, 18: 26827

review of program of French AEC on, 18: 26874
REACTOR FUEL ALLOYS
development for fast reactors, 18: 26824(R) (ANL-6885)
REACTOR FUEL ELEMENTS
boiling burnout heat flux in fog-cooled 19-rod bundle, 18: 26900 (HW-80523(Rev.1))
burnup testing of aluminum-clad uranium dioxide, 18: 26897(R) (ANL-6868(p.175-87))
burnup testing of niobium–zirconium alloy-clad uranium sulfide, 18: 26897(R) (ANL-6868(p.175-87))
charging machine for gas- or liquid-cooled reactors, 18: 26854(P)
cladding with ferrous metals, using molybdenum barrier, 18: 25962(P)
creep bowing of, analysis of, 18: 26938
design, 18: 26909(P)
design and reprocessing for French reactors, 18: 26902
design of assembly for boiling reactors, 18: 26952(P)
design of cluster, for improved flux distribution, 18: 26911(P)
design of cluster, for increased rigidity, 18: 26912(P)
design of finned, 18: 26913(P)
design of finned, for stability in coolant flow, 18: 26908(P)
development and testing, 18: 26893(R) (ANL-6868(p.11-108))
development for fast reactors, 18: 26824(R) (ANL-6885)
development for gas cooled nuclear reactors, heat transfer considerations in, 18: 26905
development, fabrication, and economics of plutonium, 18: 25947
dissolution of irradiated uranium-based, 18: 25610 (SGAE-CH-4/1964)
fabrication of hydride-containing, 18: 25960(P)
fabrication of plutonium-239- and uranium-233- containing, possibilities and consequences of accidents in, 18: 25711 (ORNL-3441)
failure detection by fission product escape, apparatus for, 18: 25856(P)
failure in gas-cooled reactors, fission product monitor for, 18: 26859(P)
instability of cylindrical, analysis, 18: 26906
loading and unloading in reactors, device for, 18: 26846(P)
loading and unloading jig for supporting, 18: 26847(P)
neutron flux calculation for, thermal, 18: 26899 (HW-50086)
neutron resonance capture in heterogeneous, variational principle for, 18: 26870
stabilizing device design for, 18: 26910(P)
support device for pressurized water marine reactors, 18: 26961(P)
welding of end cap to sheath, method and apparatus for, 18: 25959(P)
REACTOR FUEL ELEMENTS (CERAMIC)
diffusion of fission products from coated and uncoated particles in, 18: 25983 (SGAE-ME-1/1964)
properties of, chemical and mechanical, 18: 26060
reactivity Doppler feedback in lattices of, analysis of, 18: 26868
thermal conductivity of oxide, at high fission depletions, in-pile, 18: 26073 (WAPD-246)
REACTOR FUEL ELEMENTS (DISPERSION)
burnup testing of chromium–nickel alloy- and stainless steel-supported uranium, 18: 26897(R) (ANL-6868(p.175-87))
REACTOR FUEL ELEMENTS (THERMOELECTRIC)
materials development for, 18: 26259
research on cesium-vapor thermionic cells using carbide emitters, 18: 26253(R) (GA-4677)
REACTOR FUEL PINS
end closure of, welding method for, 18: 26907(P)
fabrication methods for, collapse-clad, 18: 26914 (ACNP-63031)
REACTOR FUEL RODS
desheathing machine for, 18: 25661(P)
design for horizontal arrangement in power reactors, 18: 26953(P)
fabrication by extrusion and sintering, 18: 25942 (GEAP-4556)
failure of sheathed aluminum–iron–uranium alloy, 18: 25910(P)
neutron transport in, collision probabilities for, 18: 26872
REACTOR FUELS
analysis for uranium-235, radiometric, 18: 25269(R) (NLCO-905)
crystal properties of uranium, effects of working on, 18: 25269(R) (NLCO-905)
crystal structure of uranium, detection of preferred orientation in, 18: 25269(R) (NLCO-905)
development of plutonium-bearing, 18: 25895(R) (NUMEC-2389-3)
economic aspects, 18: 26904
processing fast-reactor, methods for, 18: 26824(R) (ANL-6885)
properties of plutonium-containing, 18: 25995
radiation effects on uranium-based, bibliography on, 18: 26072 (VDDIT-16(4.2))
separation of plutonium from, 18: 25630(P)
REACTOR MATERIALS
development of, conference on, 18: 25907
development of, effects of environment on, 18: 26096
properties of fused-salt, 18: 26937
properties of, review of, 18: 26033
property requirements for, 18: 26034
testing of, electromagnetic and magnetic methods of nondestructive, 18: 25678
REACTOR MATRICES
lattice parameters for heavy-water 2% enriched-uranium, 18: 26886
power distributions and control rod worths in two-region clustered uranium dioxide–heavy water, 18: 26863 (CVNA-134)
REACTOR MODERATORS
design of graphite structure, 18: 26836(P)
design of graphite, for compensation of Wigner growth, 18: 26841(P)
support of structures of, linkwork assembly with tension device for, 18: 26852(P)
support structure design for vertical, 18: 26842(P)
REACTOR SAFETY
analysis in fast and thermal reactors, 18: 26824(R) (ANL-6885)
fission product retention in sodium at 900 to 1400°F, 18: 25326 (NAA-SR-Memo-9383)
REACTOR SAFETY EXPERIMENTS
design of in-pile loop for TREAT, 18: 26824(R) (ANL-6885)
fuel element testing in Treat, 18: 26893(R) (ANL-6868(p.11-108))
reactivity Doppler feedback in SPERT I, analysis of, 18: 26868
REACTOR SHIELDING
design of neutron scatter plug, 18: 26837(P)
REACTOR SIMULATORS
use of ATR (NRTS) open-loop, 18: 26825 (BAW-1228)
REACTOR TUBES
development of, effects of environment on, 18: 26096
thermal insulation-guide unit for, 18: 26835(P)
REACTORS
core design philosophy of General Electric, 18: 26826
core structure support, linkwork assembly with tension device for, 18: 26852(P)
core structure, sealing of adjacent blocks for reduced coolant leakage, 18: 26848(P)
design with core retaining wall, 18: 26891(P)
design with moving fuel element chains, 18: 26892(P)
electricity production from ionizing energy of, 18: 26254
loading and unloading of, grab device for, 18: 26844(P)
loading and unloading in, device for supporting fuel elements during, 18: 26846(P)
loading and unloading jig for supporting fuel elements, 18: 26847(P)
loading and unloading, transfer mechanism for, 18: 26855(P)
loading and unloading, charge machine for, 18: 26860(P)
neutron counting in, fission chamber design for, 18: 25780(R) (GEAP-4604)
neutron flux distribution determination from activity of medium flowing in, 18: 26865(T) (AEC-tr-6227/1(p.47-9))
neutron flux from eccentric point source in spherical, buckling from, 18: 26869
neutron transport in, equations for, 18: 26866
neutron transport in infinite slab, equations for, 18: 26867
neutron transport in cylindrical lattices of, collision probabilities for, 18: 26872
safety analysis of Plutonium Recycle Experiment, 18: 26824(R) (ANL-6885)
safety studies of fast and thermal, 18: 26824(R) (ANL-6885)
thermionic materials development for, 18: 26259
REFRACTORY MATERIALS
book: *High-Temperature Materials.* No. 2, *Properties Index*, 18: 26064(T)
corrosion by oxygenated liquid sodium, inhibition by cathodic protection, 18: 25919(R) (ANL-6868(p.190-200))
crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
diffusion of oxygen in, thermodynamics of, 18: 26035

fabrication for absorption of slow neutrons, 18: 25958(P)
fabrication of tubular, 18: 25939(R) (ANL-6868(p.201-18))
melting of metallic, yttrium-coated tungsten electrodes for arc, 18: 25918(P)
thermal properties, 18: 25986 (WADD-TR-60-581(Pt.IV))
RELATIVITY THEORY
Einstein-Schrödinger unified field theory in general, 18: 26388
field theory and general, 18: 26389
nan-center problem in, convergence of approximation and in, 18: 26397
space quantization in, 18: 26387(R) (ORNL-3582(p.41-5))
RELAYS
design of selector system for infrared analysis of isotopic impurities in heavy and light water, 18: 25313(P)
REMOTE-CONTROL EQUIPMENT
design for caves, 18: 25641
design of magnetic fluid-tight conveying apparatus, 18: 25653(P)
design of manipulators for hot cells, 18: 25644
design of transfer mechanism for fuel elements in reactor, 18: 26855(P)
development of master-slave system, 18: 26824(R) (ANL-6885)
REMOTE-VIEWING EQUIPMENT
cooling hose design for television camera in reactor, 18: 25649(P)
REPTILES
liver ultrastructure of lizards after injection of thorium dioxide, 18: 25066
RESEARCH REACTORS
design of test, with adjustable neutron flux, 18: 26972(P)
experimental facilities for tank-type, hydraulic sample changer for, 18: 26973(P)
irradiation facilities for Japanese Research Reactor-3, design of low-temperature, 18: 26963(T) (KFK-tr-139)
neutron density fluctuations in coupled subcores of Iowa State UTR-10, 18: 26971
neutron experiments at Dutch high-flux, description of, 18: 26965
planning research programs for, general outline of, 18: 26966
power spectral density of subcritical, measurement of, 18: 26970
RESINS
chloride activity in Amberlite IRA-410, invasion correction function for, 18: 25297
radiation effects on exchange capacity and specific volume, gamma, 18: 25541
radioinduced crosslinking reactions in polyester, hardening in, 18: 25527(T) (AEC-tr-6372(p.533-8))
radioinduced crosslinking reactions with di- and triethylamines, piperidine, and pyridine, hardening in, 18: 25528(T) (AEC-tr-6372 (p.539-46))
RESORCINOL
deuterium–hydrogen exchange in alkaline solution of, 18: 25453
RESPIRATION
tracer studies of glucose, 18: 25063
RESPIRATORY TRACTS
iodine-131 content in trachea of guinea pigs after injection, effect of thyroidectomy on, 18: 25062
RETICULO-ENDOTHELIAL SYSTEM
activity of, effects of injected lipids on, 18: 25217
RHAMNOSE
oxidation by sodium chlorite tritium kinetic isotope effects in, 18: 25459
RHENIUM
alloying effects on niobium oxidation, 18: 25936
alloying effects on electric conductivity, hardness, and structure of niobium, 18: 25999
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
fission by helium ions at energies up to 40 Mev, product yields, 18: 26670
RHENIUM ALLOYS
Hf–Re–W, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Hf–Re–Zr, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Mo–Re, dislocation twinning in, mechanism, 18: 26063
Mo–Re, internal friction in deformed crystals of, 18: 26041(T)
Re–W, fabrication of tubing of, by extrusion and drawing, 18: 25894(R) (NMI-2128)
Re–W, properties, 18: 25976 (NMI-1261)
RHENIUM ELECTRODES
performance in thermionic cells, 18: 26933
RHENIUM ISOTOPES Re-187
resonance fluorescence in, 18: 26685
RHENIUM OXIDES
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
RHODIUM
helium-3 elastic scattering at 20 Mev, differential cross sections, 18: 26681
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26668
RHODIUM ALLOYS
Au–Nb–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Co–Nb–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Fe–Rh, magnetic hyperfine structure of iron in, 18: 25982(R) (ORNL-3582(p.18-19))
Ir–Nb–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Nb–Pd–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Nb–Pt–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Nb–Rh, crystal structure and superconductivity, 18: 25970(R) (ANL-6868 (p.303-25))
Nb–Rh, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Nb–Rh, phase studies, 18: 25988
Nb–Rh–Ru, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Rh–Ta, phase studies, 18: 26048
Rh–Ta, phase studies, 18: 25988
RHODIUM CHLORIDES
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
RHODIUM ISOTOPES Rh-104
design for measuring gamma emission in neutron capture, 18: 26666
neutron capture by, gamma spectra from, 18: 26666
RIBONUCLEIC ACID
radiation effects on synthesis of, in strain L cells, gamma, 18: 25209
RIBONUCLEIC ACID, DESOXY-
protective effects against genetic effects of x radiation on rats, 18: 25215(T) (AEC-tr-6227/1(p.25-44))
radiation effects on level of, in lymphocytes of spleen of rats, 18: 25137
radiation effects on synthesis of, in strain L cells, gamma, 18: 25209
radiation effects on chromatographic profiles of isolated and unseparated fractions of, from rat spleen, 18: 25084 (NYO-2568-1)
radiation effects on synthesis of, in mouse spleen *in vitro*, 18: 25186
radioinduced changes in halogen-substituted uracil in, 18: 25593
RIBOSE
oxidation by sodium chlorite tritium kinetic isotope effects in, 18: 25459
ROCKET MOTOR NOZZLES
development of graphite, thermal stress analysis for, 18: 26116 (WADD-TR-61-72(Vol.XIX))
ROCKETS
propulsion by electrical-chemical hybrid system, performance analysis, 18: 25635
stress analysis of pressurized multicell, 18: 25633 (ERR-AN-336)
ROCKS
analysis for mercury, activation, 18: 25307
cesium, iodine, and strontium adsorption by, from natural waters, Cape Thompson, Alaska, 18: 25688 (TID-20638)
fluorine, phosphorus, radium, thorium, and uranium contents in marine, 18: 25686
separation of uranium for nuclear power production from, economics of, 18: 26917 (DM-72)
RODS
boiling burnout heat flux in fog-cooled 19-rod bundle, 18: 26900 (HW-80523(Rev.1))
ROOTS
radiosensitivity of, effects of catalase activity and gibberellic acid on, in beans, 18: 25183

ROSE BENGAL
use of iodine-labeled, in hepatic and renal function studies, 18: 25050
RUBBER
diffusion of hydrogen through, 18: 25467 (AWRE-O-54/57)
permeability of latex and neoprene, to gases, 18: 25315 (AWRE-O-56/57)
RUBIDIUM
melting temperature of, equations for calculating, 18: 25990
RUBIDIUM ISOTOPES Rb-86
uptake by erythrocytes of cancer patients, 18: 25074
RUBIDIUM ISOTOPES Rb-87
nuclear magnetic resonance of, chemical shifting by paramagnetic ions, 18: 25425
RUBIDIUM OXIDES
B_2O_3–Rb_2O, radiation effects on ESR spectra of, 18: 26079
RUBIDIUM URANYL NITRATES
neutron fission of oriented uranium-235 in, 18: 26554(R) (ORNL-3582 (p.121-6))
RUBIES
radiation effects on optical properties of, gamma, 18: 26078
RUTHENIUM
separation from aqueous solutions by sorption on ferric oxide precipitate, 18: 25632(P)
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
RUTHENIUM ALLOYS
Nb–Rh–Ru, crystal structure and superconductivity, 18: 25970(R) (ANL-6868(p.303-25))
Nb–Ru, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Ru–W, phase studies, 18: 26045
RUTHENIUM NITROSYLS
separation of nitrato and nitro complexes of, by chromatography, 18: 25602 (AERE-R-4583)

S

SAFETY
in industrial uses of radioactive tracers, 18: 25725
SAFETY HAZARDS
accidents in fuel fabrication and radioisotope processing plants, theoretical possibilities and consequences of, 18: 25711 (ORNL-3441)
in fallout shelters from water shortage, 18: 25714
in operation of ICPP Waste Calcining Facility, analysis of, 18: 26977 (IDO-14620)
of space flight, 18: 25045
SALAMANDERS
radiation effects on auditory organs in, protective effects of parabiosis against, x, 18: 25148
SALICYLIC ACID
additive effects on radioinduced graft polymerization of polypropene to acrylonitrile, 2-methyl-5-vinyl pyridine, and styrene, 18: 25505(T) (AEC-tr-6372(p.363-9))
SALTS
analysis for cerium using sodium molybdate, titrimetric, 18: 25287
SAMARIUM
determination using Xylenol Orange, spectrophotometric, 18: 25285
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
helium-3 elastic scattering at 20 Mev, differential cross sections, 18: 26681
magnetic moment of ions of, in crystalline state and in solution, 18: 25350
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
separation from scandium by cation exchange chromatography, 18: 25613
solvent extraction from nitric acid solutions by TBP, calculated cascade equilibria for, 18: 25624
spectra in thorium oxide at 100°K, nephelauxetic effects on reflection, 18: 25423
SAMARIUM AZIDES
thermal decomposition of, differential thermal analysis of, 18: 25446
SAMARIUM CARBONATES
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354
SAMARIUM CHLORIDES
complexes with 1,10-phenanthroline, structure and thermal stability of, 18: 25387
entropy of formation and vapor pressure over, 18: 25426
KCl–$SmCl_3$, vapor pressure, 18: 25435
SAMARIUM IONS
spectra in alkali halide crystals at low temperatures, absorption and emission, 18: 25406(T)
SAMARIUM ISOTOPES Sm-146
alpha decay of, energies and rates for, 18: 26640
SAMARIUM NIOBATES
$CaMoO_4$–$SmNbO_4$, fluorescence spectra, 18: 26017
$CaMoO_4$–$SmNbO_4$, preparation and spectra of, 18: 26017
$CaWO_4$–$SmNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
SAMARIUM NITRATES
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354
SAMARIUM OXALATES
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354
SAMARIUM OXIDES
reactions with uranium dioxides, 18: 26896(R) (ANL-6868(p.133-74))
Sm_2O_3, corrosion by steam at 650°C and water at 360°C, 18: 25919(R) (ANL-6868(p.190-200))
SAMARIUM PERCHLORATES
thermal decomposition of, differential thermal analysis and thermogravimetric studies on, 18: 25396
SAMARIUM PHOSPHATES
preparation and single crystal growth of ortho-, 18: 25356
SAMARIUM SULFATES
reduction of anhydrous, by carbon monoxide, 18: 25427
thermal decomposition at 25 to 1400°C, thermogravimetric analysis of, 18: 25354
SAMARIUM TANTALATES
fluorescence spectra, 18: 26017
SANITARY ENGINEERING
following thermonuclear attack, 18: 25720
SAP (SINTERED ALUMINUM PRODUCTS)
corrosion of Trefimetaux, by water at 290 and 315°C, 18: 25919(R) (ANL-6868(p.190-200))
SATELLITES
Explorer XII observations on electron distribution in outer radiation zone and magnetosphere boundary, 18: 26246
radioactivity of Sputnik 4 fragment, 18: 26127
SCALERS
use of fast, with pulse-height analyzer, 18: 25810 (NAS-NRC-Pub-1184 (p.184-5))
SCANDIUM
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
separation from rare earths and yttrium by cation exchange chromatography, 18: 25613
SCANDIUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
SCANDIUM COMPLEXES
with dialkyl phosphoric acids, preparation and properties, 18: 25429
SCANDIUM ISOTOPES Sc-43
production in proton reactions with silver at 2.9 Bev, range studies of, 18: 26648
SCANDIUM ISOTOPES Sc-44
production in proton reactions with silver at 2.9 Bev, range studies of, 18: 26648
SCANDIUM ISOTOPES Sc-45
alpha reactions (α,αn), (α,n), (α,2n), (α,2p), and (α,2pn) at 15 to 40 Mev, excitation functions for, 18: 26649
SCANDIUM ISOTOPES Sc-46

determination of ratio with scandium-48 in titanium oxide targets, spectrometric, 18: 25298
SCANDIUM ISOTOPES Sc-48
determination of ratio with scandium-46 in titanium oxide targets, spectrometric, 18: 25298
SCANDIUM NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
SCANDIUM PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
SCANDIUM TANTALATES
fluorescence spectra, 18: 26017
SCATTERING
amplitude of elastic, high-energy, 18: 26322
amplitudes for, identity on, 18: 26287
amplitudes in mass-shell, 18: 26410
amplitudes in, angular momentum separation in three-body, 18: 26336
amplitudes of elastic, analytic properties of partial wave, 18: 26383
amplitudes of, decomposition of analytic relativistic S-matrix elements into Lorentz invariant, 18: 26294
bound states and renormalization in potential, 18: 26413
effects of final-state interactions on, 18: 26379
excitations in nuclear, Fermi-liquid model for collective, 18: 26612
Hartree-Fock-Slater factors for atoms, 18: 26234
interference of Rayleigh and nuclear-resonant, in crystals, 18: 26656
model for Van Hove's $G_s(r,t)$, simple binary, 18: 26421
nonlocal effects of Moeller and Bhabha, at high energies, 18: 26289
path integrals in Feynman representation of, functional, 18: 26427
perturbation theory for three-particle system, 18: 26432
potential, asymptotic convergence in, 18: 26301
potential, field theory for singular, 18: 26415
potential, perturbation theory for strong repulsive, 18: 26302
representations of SU(3), 18: 26355
S matrix for many-channel, 18: 26283
theory of coulomb, Fourier integrals in, 18: 26280
theory of inelastic, matrix elements and parity rules for, 18: 26651
theory of multiple, 18: 26307
theory of, Jost functions in, 18: 26304
wave equations for nonlocal solvable interactions in, Schroedinger, 18: 26404
Wick's theorem in, 18: 26398
SCINTILLATION
used for measuring radiation intensity variations in cardiovascular studies, 18: 25051
SCINTILLATION DETECTORS
efficiency of plastic, for 1- to 10-kev photons, 18: 25845
efficiency of thallium-activated sodium iodide crystal, 18: 25865
use in carbon-14 determination, 18: 25293
use of liquid, for determination of tritium in form of hydrocarbon and water, 18: 25301
SEA WATER
radioactivity of, in Pacific Ocean, 131° 57′E to 164° 00′W longitude and 52° 57′ to 08° 45′N latitude, 1961, 18: 25690
separation of uranium for nuclear power production from, economics of, 18: 26917 (DM-72)
SEALS AND GLANDS
design for adjacent blocks in reactor core structure, for reduced coolant leakage, 18: 26848(P)
design for thermocouple connections in pressure vessel cover, 18: 26840(P)
SEED
genetic effects of gamma radiation in *Sorghum arundinaceum*, 18: 25131
radiation effects on nucleic acid metabolism in, 18: 25175
radiation effects in grass, genetic, 18: 25177
radiosensitivity, 18: 25133
radiosensitivity of rye, effects of moisture, temperature treatment, radiation wave length, and ascorbic acid content on, 18: 25126
radiosensitivity of onion, effects of aging on, 18: 25179
radiosensitivity of castorbean, 18: 25180
radiosensitivity of oat, effects of moisture content on, 18: 25181
radiosensitivity of barley, 18: 25182
sensitivity of barley, to ethyl methanesulfonate, 18: 25182
sensitivity of castorbean, to ethyl methanesulfonate, 18: 25180
SEIGNETTOELECTRIC MATERIALS
properties of, hysteresis bridge for measurement of, 18: 25738 (BNL-8006)
SELENIUM
neutron scattering cross sections at 0.5 to 0.8 Mev, 17: 26571
SELENIUM ISOTOPES
spectra in hydrogen selenide, analysis of near-infrared, 18: 25437
SELENIUM ISOTOPES Se-76
oxygen-ion inelastic scattering at 37 Mev, coulomb excitation in, 18: 26610
SELENIUM ISOTOPES Se-78
oxygen-ion inelastic scattering at 37 Mev, coulomb excitation in, 18: 26610
SELENIUM OXIDES
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
SEMICONDUCTOR DETECTORS
amplifier design for, transistorized low-noise pre-, 18: 25789 (NAS-NRC-Pub-1184(p.61-4))
book: *Semiconductor Particle Detectors*, 18: 25848
circuitry for identifying charged particles from energy and time-of-flight, 18: 25794 (NAS-NRC-Pub-1184(p.96-103))
design and performance of position-sensitive, 18: 25784 (NAS-NRC-Pub-1184(p.42-5))
design of linear junction, 18: 25858(P)
design, performance, and uses, 18: 25837
operation principles and characteristics, 18: 25836
preparation of, use of radioisotopes in, 18: 25846
pulse amplifier for, low-noise, 18: 25790 (NAS-NRC-Pub-1184(p.65-9))
pulse amplitudes and waveforms from alpha-excited, temperature and voltage bias effects on, 18: 25786 (NAS-NRC-Pub-1184(p.49-52))
pulse output of, time resolution limits in, 18: 25787 (NAS-NRC-Pub-1184(p.53-8))
radiation detection with, review on, 18: 25850
timing aspects of, collection times and rise-time in, 18: 25788 (NAS-NRC-Pub-1184(p.59-60))
SENA POWER REACTOR
design and development in 1963, 18: 26920(R) (EUR-1804.f)
SEPARATION PROCESSES
development of ionophoresis, 18: 25612(T) (ORNL-tr-128)
SERUMS
protective effects on leptospirosis antibody formation in irradiated rabbits, 18: 25228
SHEEP
radiation dose to gastrointestinal tract in, from ingested insoluble radioisotopes, 18: 25142
SHELLS
stress analysis of filament-wound laminated structures, 18: 26115 (SCL-TM-64-53)
SHELTERS
design of fallout, 18: 25681(P)
radiation dose rates in compartmentalized, gamma and neutron, 18: 25712 (USNRDL-TR-722)
water supply for fallout, 18: 25714
SHIELDED CONTAINERS
design for neutron auto-radiography of encapsulated irradiated fuels, 18: 26068 (ANL-6799)
design for shipping fission products, evaluation of, 18: 25707 (HW-65268 (Rev.1))
design with wheels, 18: 25736(R)
testing for fission product shipping, drop, 18: 25708 (HW-77962)
SHIELDING
development for radiation detection equipment, 18: 25835
development of electromagnetic pulse, for communication systems, 18: 26819
development of space-vehicle, problems in, 18: 26816
fabrication of pliable sheeting, 18: 25909(P)
magnetic, theory and experiments on, for space vehicles, 18: 26107 (ERR-FW-210)
properties of steel, for mesons (μ), 18: 26165 (BNL-837(p.91-113))
radiation dose rates in compartmentalized shelters, gamma and neutron,

18: 25712 (USNRDL-TR-722)
shape of, for disc radiation source, 18: 26818
SHIELDING MATERIALS
gamma buildup factors for, 18: 26814(T) (ORNL-tr-80)
SHIPPING
cask design evaluation for fission product, 18: 25707 (HW-65268(Rev.1))
cask testing for fission product, 18: 25708 (HW-77962)
SHIPPINGPORT PRESSURIZED WATER REACTOR
operation, Apr. 1964, 18: 26916(R) (DLCS-5000464)
operation, Mar. 1964, 18: 26915(R) (DLCS-5000364)
SHOCK TUBES
shock separation from driven gas in electromagnetic, 18: 25645
SHOCK WAVES
attenuation in ionized gas in transverse magnetic field, 18: 26802
biological effects of, from atomic explosion, 18: 25722
diffraction in gases, analysis of, 18: 26123
diffraction of cylindrical elastic and weak, 18: 26141
interactions with electromagnetic waves in d-c magnetic fields, 18: 26125
production of imploding spherical, by mirror coil, 18: 26151
propagation in gases in magnetic fields, evolution of trans-Alfvenic, 18: 26122
propagation in plasma in transverse magnetic fields, analysis of, 18: 26752
propagation of electromagnetically driven, 18: 26795
properties of plane perpendicular magnetogasdynamic, in fully ionized perfect gas, 18: 26693 (RISO-76)
reactions with gases, Mach stems in, 18: 26137
reflection from rigid walls, analysis of, 18: 26123
structure in dilute plasma, 18: 26697(T) (AEC-tr-5589(p.554-64))
structure in gases, 18: 26786
structure in magnetohydrodynamics, effects of electron inertia on, 18: 26149
structure in plasma, 18: 26740
structure of, kinetic theory solutions for, 18: 26138
SILICON
additive effects on uranium crystal structure, 18: 25269(R) (NLCO-905)
additive effects on niobium oxidation, 18: 25936
additive effects on electric conductivity, hardness, and structure of niobium, 18: 25999
additive effects on corrosion of zirconium alloys by steam, 18: 26824(R) (ANL-6885)
deposition on niobium–zirconium alloy by fluidized bed method, 18: 25896(R) (PF-63-3)
order in calcium boron silicates, 18: 25366
radiation effects at 40 and 440 Mev on transistors of, proton, 18: 26091
radioinduced defects in impurity-doped crystals of, energy levels of electron, 18: 26089(T)
SILICON CARBIDES
analysis by beta spectroscopy, qualitative and quantitative, 18: 25303
SILICON ISOTOPES Si-28
energy levels, 18: 26661
neutron elastic and inelastic scattering at 14.1 Mev, 18: 26600
proton reactions (p,2p) at 185 Mev, 18: 26567
proton reactions (p,γ) at 1.3 to 3.2 Mev, 18: 26593
SILICON ISOTOPES Si-30
proton reactions (p,γ), phosphorus-31 spin-parity from, 18: 26635
SILICON ISOTOPES Si-32
beta spectrum, 18: 26586
SILICON OXIDES
corrosion by cesium in in-pile thermionic cells, 18: 26259
determination in cements by x-ray fluorescence, 18: 25275
electric discharge thermal shock effects on, 18: 26806
electric properties, 18: 26058
sputtering by argon at 12 kev, 18: 26806
tumorigenetic effects of implants of, in rats, 18: 25053
SILICON SYSTEMS
Al–Fe–Si–U, fabrication of rods and tubes by rolling, 18: 25940 (BMI-X-294)
Al–Ni–Si, corrosion behavior and mechanical properties in high-temperature water, 18: 25931
Mo–Si, diffusion reactions at 1250°C, 18: 26001
Si–Tc, crystal structure and phase studies, 18: 25970(R) (ANL-6868 (p.303-25))
SILICONE POLYMERS
radioinduced polymerization of solid, epitaxy in, 18: 25502(T) (AEC-tr-6372(p.323-30))
radioinduced polymerization of, activation energy and kinetics of, 18: 25503(T) (AEC-tr-6372(p.331-47))
SILICONES
air-silicone fluids, theory of two-phase annular flows of, 18: 25657(R) (NYO-3114-1)
SILTS
fluorine, phosphorus, radium, thorium, and uranium contents in, 18: 25686
SILVER
beta absorption, effects of atomic weight on, 18: 26812(T) (AEC-tr-6372(p.11-15))
beta transmission through, backscattering from, 18: 26813(T) (AEC-tr-6372(p.17-28))
diffusion of palladium in, 18: 25969(R) (ANL-6868(p.287-302))
effects on stress corrosion of aluminum–copper–magnesium–zinc alloys, 18: 25946(T) (RSIC-177)
gamma scattering at 662 kev, Rayleigh, 18: 26292
melting point of, correlation with energy of motion of monovacancies, 18: 26037
melting temperature of, equations for calculating, 18: 25990
neutron elastic scattering at 5.0 Mev, angular distribution, 18: 26668
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26668
nucleation on tungsten, field-emission microscopy of, 18: 26054
protective effects against nucleic acid decomposition by nuclease, 18: 25085 (SGAE-BL-5/1964)
proton reactions at 2.9 Bev, ranges of recoil products from, 18: 26648
radiation effects on crystalline, 18: 26069(R) (ANL-6868(p.373-417))
radiation effects on indium-111 gamma angular correlations in, 18: 26085
radiation from electron-bombarded foils of, temperature and thickness in transition, 18: 26224
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
superconducting films of, edge-effect suppression in, 18: 26482
SILVER ALLOYS
Au–Ag, electric conductivity and Mossbauer shifts of gold in, 18: 26534(R) (ORNL-3582(p.16-17))
Cd–In–Ag, radiation effects on microstructure, 18: 26897(R) (ANL-6868 (p.175-87))
Mg–Ag, self-diffusion of silver-110 in, 18: 26051
SILVER COMPLEXES
with dialkyl phosphoric acids, preparation and properties, 18: 25429
SILVER ISOTOPES Ag-110
diffusion in magnesium–silver alloys, self-, 18: 26051
SILVER NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
SINGLE CRYSTALS
gamma nuclear-resonant scattering in, 18: 26657
radiation effects on deformation of zinc, 18: 26090
SIOUX FALLS POWER REACTOR
fuel element fabrication for, collapse-clad, 18: 26914 (ACNP-63031)
SKIN
anatomy and physiology of, 18: 25038 (AHSB(RP)R-39(p.1-10))
biological effects of radiation on, 18: 25081 (AHSB(RP)R-39(p.21-9))
blood flow through dog, krypton-85 measurement of, 18: 25070
decontamination of, review of methods for, 18: 25233
permeability to radioactive contaminants, 18: 25056 (AHSB(RP)R-39 (p.79-86))
radiation dosimetry, 18: 25083 (AHSB(RP)R-39(p.44-68))
radiation dosimetry in, from external exposure, 18: 25082 (AHSB(RP)R-39(p.31-43))
radiation effects on homograft survival in rat, beta, 18: 25112
radiation effects on homograft survival in rat, x, 18: 25114
radiation effects on rabbit, fluid flow method for detection of, 18: 25134
radiation effects on, 18: 25146
radiation injury, 18: 25214 (AHSB(RP)R-39(p.87-93))
radioactive decontamination, 18: 25213 (AHSB(RP)R-39(p.69-77))
radiosensitivity of mouse, 18: 25081 (AHSB(RP)R-39(p.21-9))

radiosensitivity, effect of dose fractionation on, 18: 25192
SKIN DISEASES
effectiveness of x radiation in treatment of acne vulgaris, 18: 25235
production by light-induced reactions of photodynamic compounds, 18: 26983 (NYO-2734-1)
SKIN GRAFTING
effects of exposure of grafts to ultraviolet radiation on viability, 18: 25113
SLUG CANS
development of stainless steel, 18: 26946
development of, effects of environment on, 18: 26096
SNAILS
radionuclide uptake from water in pond, 18: 25079
SODIUM
corrosive effects on metals, 18: 25937
corrosive effects on refractory alloys at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
diffusion of iodine in, at 900 to 1400°F, 18: 25326 (NAA-SR-Memo-9383)
heat transfer by liquid, design of test installation for study of, 18: 25661
melting temperature of, equations for calculating, 18: 25990
neutron scattering cross sections at 0.5 to 0.8 Mev, 18: 26571
protective effects against nucleic acid decomposition by nuclease, 18: 25085 (SGAE-BL-5/1964)
reactions of liquid, with carbon monoxide, 18: 26824(R) (ANL-6885)
solvent properties of liquid, for carbon, 18: 26824(R) (ANL-6885)
sorption on quartz, measurements by ion-exchange membrane electrodes, 18: 25327 (RT/GEO(64)-1)
sound absorption in liquid, magnetically induced, 18: 26131
use as reactor coolant, review on, 18: 26829
SODIUM ACID CARBONATES
reaction with uranyl carbonate complexes, 18: 25428
SODIUM ALLOYS
Na–Sr, phase studies, 18: 25984 (TID-20639)
SODIUM BROMIDES
samarium spectra in crystals of, at low temperatures, 18: 25406(T)
SODIUM CARBONATES
reaction with uranyl carbonate complexes, 18: 25428
SODIUM CHLORIDES
cleavage energy of crystals of, effects of color center density and testing environment, 18: 25973 (ASD-TDR-63-605(Pt.II))
corrosive effects on zinc, tracer studies on, 18: 25927
diffusion of zinc in pure and zinc-doped, 18: 25969(R) (ANL-6868 (p.287-302))
electric conductivity of pure and zinc-doped monocrystalline, 18: 25969(R) (ANL-6868(p.287-302))
radiation effects on crystalline, 40-Mev alpha, 18: 26071 (NASA-TN-D-2329)
radiation effects on dislocation distribution and microhardness of, 18: 26082
spectra in, optical absorption, 18: 25408
SODIUM CHLORITES
oxidative effects on tritium-labeled aldoses, kinetic isotope effects in, 18: 25459
oxidative effects on carbon-14- and tritium-labeled glucose, kinetic isotope effects in, 18: 25459
SODIUM FLUORIDES
spectra in, optical absorption, 18: 25408
SODIUM GADOLINATES
magnetic properties and structure of, 18: 25397
SODIUM HYDROXIDES
corrosive effects on niobium and vanadium, effects of acidity and current density on anodic, 18: 25929
SODIUM HYPOCHLORITES
H_2O_2–NaOCl, chemiluminescence at 3000 to 7500 A, 18: 25371
SODIUM IODIDES
efficiency of thallium-activated crystals of, gamma, 18: 25865
isotope exchange with organic iodides, electrochemical determinations of kinetics in, 18: 25424
samarium spectra in crystals of, at low temperatures, 18: 25406(T)
SODIUM ISOTOPES Na-21
beta-decay branching ratios in, 18: 26565
SODIUM ISOTOPES Na-23
deuteron reactions (d,p) at 1.51 Mev, angular distributions and excited levels in, 18: 26659
neutron reactions (n,γ) with, spectra from resonant, 18: 26542(R) (ORNL-3582(p.71-5))
nuclear magnetic resonance of, chemical shifting by paramagnetic ions, 18: 25425
SODIUM ISOTOPES Na-24
energy levels, 18: 26659
production in proton reactions with silver at 2.9 Bev, range studies of, 18: 26648
SODIUM METHOXIDE
methanol–sodium methoxide, perfluorocarbanion formation in deuterium–hydrogen exchange in monohydrofluorocarbons in, 18: 25451
SODIUM MOLYBDATES
analytical use in titrimetric determination of cerium, 18: 25287
SODIUM NITRATES
corrosive effects on zinc, tracer studies on, 18: 25927
electric conductivity of molten, direct current measurement of, 18: 26018
KNO_3–$NaNO_3$, electric conductivity of molten, 18: 26018
$LiNO_3$–KNO_3–$NaNO_3$, electric conductivity at 134 to 384°C, 18: 26020
$LiNO_3$–$NaNO_3$, electric conductivity of molten, 18: 26018
SODIUM OXIDES
B_2O_3–Na_2O, radiation effects on ESR spectra of, 18: 26079
SODIUM PERXENATES
preparation and properties of, 18: 25357
SODIUM SILICATES
reaction with lanthanum sulfate, preparation of lanthanum silicates by, 18: 25433
scintillation properties in liquid helium, 18: 25849
SODIUM SULFATES
corrosive effects on zinc, tracer studies on, 18: 25927
sulfur valence in, beta spectroscopy for, 18: 25303
SODIUM SULFITES
sulfur valence in, beta spectroscopy for, 18: 25303
SODIUM SYSTEMS
NH_3–Na, electron-nuclear double resonance studies of solutions of, 18: 26154
SODIUM THIOSULFATES
sulfur valence in, beta spectroscopy for, 18: 25303
SODIUM URANATES
spectra and structure, 18: 25388
SOILS
age estimation of loess from Russian Steppe by carbon-14 method, 18: 25685
analysis for cerium-144, 18: 25265 (HASL-143)
cesium, iodine, and strontium adsorption by, from natural waters, Cape Thompson, Alaska, 18: 25688 (TID-20638)
density and moisture content determinations, uses of radioisotopes in, 18: 25699(T) (OTS-63-11008(p.15-21))
density of, apparatus for measurement of, 18: 25775(P)
fluid flow in heterogeneous partially saturated, computer program for calculating, 18: 26975 (HW-72335(Pt.2))
gamma absorption by, mass coefficients for, 18: 25700
heating by radioactive material leaking from waste storage tanks, 18: 26976 (HW-80848)
radioactivity of Arctic, effects of natural radioactivity on, 18: 25055 (NP-13985)
radioisotope concentrations in, maximum permissible, 18: 25733
SOLAR BATTERIES
development and testing of thermoelectric, 18: 26251(R) (AD-437280)
SOLAR FLARES
detection of particle streams from, using high-frequency radio waves, 18: 26247
relation to loop prominence occurrence, 18: 26193
shielding against, 18: 26815
tabulation of sunspot numbers for 1963 and January 1964, 18: 26453
SOLAR RADIATION
detection of particle streams in, using high-frequency radio waves, 18: 26247
effects of alpha particles on ionospheric radio wave absorption, 18: 26445
effects on reflectance of paint systems for space vehicles, 18: 26097

temperature at 4 mm, brightness, 18: 26192
SOLDERING
flux composition for detection under ultraviolet light, 18: 27001(P)
SOLENOIDS
flux jumping and degradation in superconducting, 18: 26463
flux jumping and training in superconducting, 18: 26470
magnetic fields of superconducting niobium–zirconium, 18: 26474
SOLID SOLUTIONS
magnetic susceptibility and nuclear magnetic resonance in, 18: 26522(R) (ANL-6868(p.326-30))
SOLIDS
coalescence and migration of pores in, 18: 26069(R) (ANL-6868(p.373-417))
electron emission from, in gas discharges, 18: 26164
electron, phonon, and spin wave scattering in, theory of, 18: 26212
mixing in fluidized-packed beds, particulate movement in, 18: 25658
quantum theory of, group theory in, 18: 26438
SOLUTIONS
electron binding in aqueous, model for, 18: 25577
radiation chemistry of aqueous, effects of acidity and oxygen on, 18: 25580
SOLVENT EXTRACTION PROCESSES
equipment design for, on micro-scale, 18: 25609 (RCC-M-173)
TBP diluent in, uses of n-paraffin mixtures for, 18: 25605 (DP-882)
SONIC INSPECTION
equipment and techniques of ultrasonic imaging, 18: 25675(R) (ANL-6868 (p.219-28))
SOUND
absorption in liquid metals, magnetically induced, 18: 26131
propagation in polyatomic gases, disturbances in, 18: 26135
SPACE
electron distribution in magnetosphere boundary, Explorer XII observations on, 18: 26246
radio sources in, properties of extended, 18: 26190
x-ray sources in, 18: 26200
SPACE FLIGHT
medical problems in, 18: 25045
radiation protection of eyes during, 18: 25044
SPACE VEHICLES
power plants for, development of thermoelectric, 18: 26251(R) (AD-437280)
radiation effects on paint systems for thermal control in, 18: 26097
shielding design for, solar-proton, 18: 26815
shielding of, magnetic, 18: 26107 (ERR-FW-210)
shielding of, problems in, 18: 26816
stress analysis of pressurized multicell shell structure for, 18: 25633 (ERR-AN-336)
SPARK DETECTORS
design of neutrino, 18: 26166 (BNL-837(p.170-89))
development of wire-chamber with on-line computer, 18: 25779 (CONF-182-15)
pulser for, for air-borne experiments, 18: 25828 (TID-20646)
triggering circuit development for, 18: 25827 (NAS-NRC-Pub-1184 (p.325-30))
SPECTROMETERS
design of electron paramagnetic resonance, with combined frequency and magnetic field modulation, 18: 25762
design of interferometric, for measuring gas temperature, 18: 25764(P)
SPERM
radiation effects on count of, in guinea pigs, 18: 25191
radiation effects on number and morphology of, in bulls, 18: 25185
SPHERES
packing, 18: 26893(R) (ANL-6868(p.11-108))
ring current interactions with conducting, 18: 26770
SPLEEN
homogenates, protective effects of transfusions of, against radiation injuries in guinea pigs, 18: 25230
proliferation of, by transplanted marrow cells in irradiated mice, 18: 25189
radiation effects on DNA level in lymphocytes of, in rats, 18: 25137
radiation effects on response to virus infection of, in mice, 18: 25223
radiation effects on desoxyribonucleic acid of rat, 18: 25084 (NYO-2568-1)
radiation effects on desoxyribonucleic acid synthesis in mouse, *in vivo*, 18: 25186
SQUALENE
radiolysis at –196 to 350°C, yields, 18: 25551
STABLE ISOTOPES
uses in research, selected translations from Russian on, 18: 25868(T) (OTS-63-11008)
STAINLESS STEEL
compatibility of type 304, with fissium–uranium alloys, fissium–plutonium–uranium alloys, and uranium to 1200°C, 18: 26893(R) (ANL-6868(p.11-108))
corrosion by carbon dioxide at 650 to 800°C, 18: 26096
corrosion of type 304, by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
corrosion of types 304, 406, 430, and 446, by steam at 540 and 650°C, 18: 25919(R) (ANL-6868(p.190-200))
corrosion of types 405 and 406, by oxygenated steam at 650°C, effects of aluminum, titanium, and yttrium additions on, 18: 26894(R) (ANL-6868(p.109-16))
corrosion of 304, 316, 321, 347, and 406, by steam, 18: 26824(R) (ANL-6885)
dissolution of irradiated, equipment and methods for, 18: 25610 (SGAE-CH-4/1964)
dissolution of, media for, 18: 26903
fabrication and properties of type 406, 18: 26894(R) (ANL-6868(p.109-16))
mechanical properties at high pressures and temperatures, 18: 25972 (ASD-TDR-63-90(Vol.II))
use in reactor fuel cans, 18: 26946
STAINLESS STEEL (AUSTENITIC)
corrosion by water and steam at 300 and 400°C, effects of surface treatment on, 18: 25922(T) (EURAEC-1038)
mechanical properties at high pressures and temperatures, 18: 25972 (ASD-TDR-63-90(Vol.II))
STAINLESS STEEL ELECTRODES
electric discharge effects on, arcing in, 18: 26806
STANDARDS
for by-product regulation, AEC-state cooperation in, 18: 25715
STARCHES
radiation effects on flour, gamma, 18: 25139
STARS
formation of quasi-stellar radio sources, spherical galaxies in process of, 18: 26196
models for, dynamical stability of neutron, 18: 26199
nuclear abundances in, 18: 26187 (BNL-837(p.193-233))
STATISTICS
applications in studies of radiation effects on life span of dogs, 18: 25094(R) (UCD-472-109(p.173-7))
formalism for plasma kinetics, Dyson equation technique in, 18: 26753
properties of Bardeen–Cooper–Schrieffer distribution, 18: 26491
queueing theory in particle counting, 18: 25890
test for presence of preferred orientation in aggregates of crystallites, 18: 25269(R) (NLCO-905)
use of, in radiobiological research, 18: 25172
STEAM
decomposition on metals, thermal, 18: 26824(R) (ANL-6885)
reactions with graphite, catalytic effects of barium, cesium, and strontium on, 18: 25321 (GA-5215)
wetness of turbine exhaust, reduction of, 18: 25660
steam–water, flow pressure drop across thick plate restrictions in, 18: 25665
steam-water, two-phase expansion through convergent-divergent nozzle, 18: 25662
STEAM POWER PLANTS
design for indirect reactor steam generators, 18: 26951(P)
materials development for, 18: 26946
STEARIC ACID, ETHYL ESTER
protective effects of injected, against radiation injuries in mice, 18: 25217
STEATITES
electric properties, 18: 26058

STEEL
analysis by x-ray fluorescence, 18: 25275
analysis for oxygen, activation, 18: 25304
cobalt content in, for reactor uses, 18: 26034
corrosion by water and steam at 300 and 400°C, effects of surface treatment on, 18: 25922(T) (EURAEC-1038)
fatigue strength for uses in pressure vessels, effects of weld defects on, 18: 25680 (TID-20648)
Mössbauer effect in, plastic deformation effects in, 18: 25903(T)
neutron diffusion in blocks of, 18: 26521
radiation effects on microstructure of pressure vessel-grade, fast neutron, 18: 26092
radiation effects on tensile properties of, neutron, 18: 26096
radiation effects on electrochemical behavior, 18: 25553
radiation effects on pressure vessel, neutron, 18: 26925 (GEAP-4423)
separation of molybdenum from, by reversed-phase chromatography using hydrochloric and sulfuric acids, 18: 25280
shielding properties for mesons (μ), 18: 26165 (BNL-837(p.91-113))
weld cracking in, review of theories, effects, causes, and control of, 18: 25941 (DMIC-197)
welding of thick ASTM A302B, by electroslag techniques, 18: 25945(T,R) (EURAEC-1039)
STELLARATORS
magnetic field force lines in, effects of small perturbations on, 18: 26790
STILBENE
radioinduced polarization of fluorescence from, 18: 25594
STILBENE, 4,4'-DIPHENYL-
scintillation properties in liquid helium, 18: 25849
STOMACH
radiation effects on food passage time in, in rats, 18: 25172
STRESS ANALYSIS
of filament-wound shell structures, 18: 26115 (SCL-TM-64-53)
of irradiated fuel element, 18: 26906
STRONTIUM
catalytic effects on steam–graphite reaction, 18: 25321 (GA-5215)
content in Indian vegetables, 18: 25067
determination in leaves, micro-, 18: 25067
melting point and phase transformations, 18: 25984 (TID-20639)
melting temperature of, equations for calculating, 18: 25990
metabolism in man, 18: 25073
purification by vacuum distillation, 18: 25984 (TID-20639)
separation from Purex wastes by ion exchange, 18: 25606 (ORNL-3585)
separation from salt solution by ion exchange using basic lead sulfate, 18: 25262(P)
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
sorption by ammonium phosphomolybdates, mechanism of, 18: 25378
sorption from natural waters by earth materials, Cape Thompson, Alaska, 18: 25688 (TID-20638)
STRONTIUM ALLOYS
Na–Sr, phase studies, 18: 25984 (TID-20639)
STRONTIUM CHLORIDES
KCl–$SrCl_2$, vapor pressure, 18: 25435
STRONTIUM ISOTOPES Sr-83
production in proton reactions with silver at 2.9 Bev, range studies of, 18: 26648
STRONTIUM ISOTOPES Sr-85
uptake by biological organisms in fresh-water pond, 18: 25079
use in radiodiagnosis, 18: 25257
STRONTIUM ISOTOPES Sr-90
content in bone samples collected in Great Britain, 1963, 18: 25735
content in milk, effects of, on radiation dose to children, 18: 25727
determination in drinking water using a carrier, triple precipitation, and counting, 18: 25267 (K-1521)
distribution in food chains of, in Arctic regions, 18: 25055 (NP-13985)
effects on eyes, 18: 25146
genetic effects of, in fallout, 18: 25697
radiation hazards from chronic ingestion of, in man, 18: 25073
uptake by man, 18: 25693
STRONTIUM LACTATES
use as contrast media for diagnostic radiography, 18: 25242
STRONTIUM SULFATES
tumorigenetic effects of implants of, in rats, 18: 25053
STRONTIUM TITANATES
iron(III) EPR spectrum in, 18: 25409
STRUCTURES
stress analysis of pressurized multicell shell, 18: 25633 (ERR-AN-336)
STYRENE POLYMERS
radiation effects on reactions with chlorine and sulfur dioxide, 18: 25490(T) (AEC-tr-6372(p.197-205))
radiation effects on, ESR spectra of, 18: 25520(T) (AEC-tr-6372(p.481-90))
radioinduced optical absorption bands in, effects of oxygen on bleaching of, 18: 25568
STYRENES
radioinduced graft polymerization on casein, 18: 25469 (SRIA-120)
radioinduced graft polymerization on celluloses, solvent effects on, 18: 25474(T) (AEC-tr-6372(p.83-8))
radioinduced graft polymerization on celluloses, effects of chemical treatment, pretreatment, and refining on reactivity of, 18: 25475(T) (AEC-tr-6372(p.89-96))
radioinduced graft polymerization on viscose rayon solvent effects on, 18: 25476(T) (AEC-tr-6372(p.97-102))
radioinduced graft polymerization on PVA, heat treatment effects on x-ray scattering in, 18: 25483(T) (AEC-tr-6372(p.141-3))
radioinduced graft polymerization on polypropene, effects of additives and alpha pre-irradiation on, 18: 25506(T) (AEC-tr-6372(p.371-7))
radioinduced graft polymerization on rayon, conditions for, 18: 25534(T) (AEC-tr-6372(p.593-602))
radioinduced graft polymerization to polypropene, effects of additives and alpha pre-irradiation on, 18: 25505(T) (AEC-tr-6372(p.363-9))
radioinduced polymerization of, effects of dipheaylpicrylhydrazyl on beta, 18: 25486(T) (AEC-tr-6372(p.163-73))
radioinduced polymerization with formaldehyde, kinetics of, 18: 25492(T) (AEC-tr-6372(p.213-22))
radioinduced polymerization of, activation energy and kinetics of, 18: 25503(T) (AEC-tr-6372(p.331-47))
radioinduced polymerization with acrylonitrile, 18: 25535(T) (AEC-tr-6372(p.603-12))
acrylonitrile–styrene, product composition in radioinduced graft polymerization with cellulose, 18: 25480(T) (AEC-tr-6372(p.125-7))
butadiene–styrene, radioinduced graft polymerization on celluloses, 18: 25478(T) (AEC-tr-6372(p.109-15))
butadiene–styrene, radioinduced graft polymerization on PVA, 18: 25482(T) (AEC-tr-6372(p.135-40))
butadiene–styrene, radioinduced graft polymerization on polyethylene, 18: 25484(T) (AEC-tr-6372(p.145-57))
butadiene–styrene, structural effects in radioinduced graft polymerization on celluloses, 18: 25481(T) (AEC-tr-6372(p.129-34))
polysulfone–styrene, reactions with irradiated polypropene, 18: 25490(T) (AEC-tr-6372(p.197-205))
SUBMARINE REACTORS
economics, 18: 26960
SUBMARINES
hull model studies on nuclear-powered tanker, 18: 26959 (RTI/ING(63)-4)
SUCCINIC ACID
DL-diamino-, yields in radiolysis of aqueous glycine, 18: 25584
precipitation of cerium and lanthanum using, 18: 25351
SUGAR BEETS
radiation effects of irradiation of seed on size of leaf tissue nuclei, 18: 25136
SULFATE IONS
distribution between Dowex 1-X8 and solutions of potassium bicarbonate and carbonate, 18: 25438
SULFIDES
radiolysis in toluene solutions, energy transfer in, 18: 25548
SULFONES
polysulfone–styrene, reactions with irradiated polypropene, 18: 25490(T) (AEC-tr-6372(p.197-205))
SULFOSALICYLATE COMPLEXES
with uranium, equilibrium and stability of, 18: 25391
SULFOXIDES
diphenyl-, reactions with niobium and tantalum pentabromides and

-chlorides, 18: 25398
SULFUR
determination in coal, heavy oil, and pig iron by combustion, 18: 25302
effects on radiolysis of toluene, 18: 25547
valence determination by beta spectroscopy, 18: 25303
SULFUR COMPOUNDS
energy transfer of organic, in radiolysis in toluene solutions, 18: 25548
SULFUR DIOXIDES
radioinduced polymerization of vinyl acetate in liquid, 18: 25537(T) (AEC-tr-6372(p.617-25))
reactions with irradiated ethylene, propene, styrene, and vinyl alcohol polymers and nylon and tetrone, 18: 25490(T) (AEC-tr-6372(p.197-205))
reactions with irradiated polypropene in carbon tetrachloride, 18: 25490(T) (AEC-tr-6372(p.197-205))
spectra of oxygen-18 containing, rotational, 18: 25334
spectra of oxygen-18 containing, ground-state rotational, 18: 25335
SULFUR ISOTOPES S-32
neutron elastic and inelastic scattering at 14.1 Mev, 18: 26600
neutron reactions (n,γ) with, spectra from resonant, 18: 26542(R) (ORNL-3582(p.71-5))
neutron reactions (n,p)**P, 18: 26590
neutron total cross sections of, 18: 26543(R) (ORNL-3582(p.75-82))
SULFUR ISOTOPES S-35
exchange in organic sulfur compounds, 18: 25460
incorporation in organic sulfur compounds, 18: 25460
incorporation in sodium *N*-methyldithiocarbamate, 18: 25461
SULFUR SYSTEMS
CS_2–S–toluene, radiolysis of, formation of sulfur compounds in, 18: 25547
cyclohexane–S–toluene, radiolysis of, formation of sulfur compounds in, 18: 25547
S–toluene, radiolysis of, formation of sulfur compounds in, 18: 25547
S–Zr, stability and thermodynamics of, 18: 26065
SULFURIC ACID
corrosive effects on niobium and vanadium, effects of acidity and current density on anodic, 18: 25929
effects on hydrogen yields in radiolysis of liquid ethanol, 18: 25589
effects on reactions between hydrogen peroxide and plutonium, 18: 25390
radiolysis of aqueous solutions of, kinetics of pulsed electron beam, 18: 25578
SULFURYL CHLORIDE
reactions with irradiated polypropene in carbon tetrachloride, 18: 25490(T) (AEC-tr-6372(p.197-205))
SUN
contents of beryllium, lead, and lithium in atmosphere of, 18: 26202
evolution, 18: 26187 (BNL-837(p.193-233))
sunspot correlation with sporadic E, 18: 26440
SUPERCONDUCTIVITY
properties of Bardeen–Cooper–Schrieffer distribution, 18: 26491
surface, above critical field in type I superconductors, 18: 26480
theory of, paramagnetic effects in, 18: 26459(R) (AD-437194)
SUPERCONDUCTORS
critical currents of type-II, 18: 26472
current fluctuations in circuits of, 18: 26484
edge effects in films of, 18: 26482
energy gap of film, temperature dependence of, 18: 26487
energy gap of film, magnetic-field dependence of, 18: 26488
fabrication of thin-film, 18: 26496(P)
flux jumping and degradation in, 18: 26463
flux jumping and training in solenoids of, 18: 26470
generator of, direct-current, 18: 26465
magnetic properties of bismuth–indium alloys as second kind, 18: 26495
magnetic shielding of space vehicles by, 18: 26107 (ERR-FW-210)
magnets of, 18: 26478
normal regions in mixed-state, 18: 26489
nucleation magnetic field in, angular dependence of, 18: 26479
photoelectric effect in, frequency and temperature for, 18: 26494(T)
pinning in mixed-state, by localized composition fluctuations, 18: 26469
preparation, properties, and uses of thin-film, review on, 18: 26476
surface impedance of, 18: 26467
surface superconductivity above critical field in type I, 18: 26480
thermal conductivity of, model for electronic, 18: 26486
transformers of, layout for, 18: 26466
use for storage in memory devices, 18: 26490
use of thin-film, in storage and switching devices, 18: 26477
SUPERCRITICAL ONCE-THRU TUBE REACTOR
cost analysis for, 18: 26928 (WCAP-2294)
SUPERFLUIDITY
zero sound in Fermi, absence of, 18: 26471
SUPERHEATERS
materials development for, 18: 26946
SUPERHEATERS (NUCLEAR)
heat transfer analysis of forced-circulation, operating at subcritical pressure, 18: 26945
SURFACE WATERS
radionuclide uptake by biological organisms in fresh-water pond, 18: 25079
SURFACES
cleaning and passivation of, in atomic industry, 18: 25914(P)
decontamination of radioisotope-contaminated, 18: 25724
shock wave reflection from plane rigid, analysis of, 18: 26123
SUSPENSIONS
flow of gas-solid, turbulence in, 18: 25656 (NYO-2930-2)
SWINE
lethal gamma radiation dose for, 18: 25188
radiation effects in, gamma, 18: 25188
SWITCHES
development of superconducting thin-film, 18: 26477
development of superconducting, for magnetic energy storage systems, 18: 26493
use of transistorized circuit as linear gate, 18: 25798 (NAS-NRC-Pub-1184(p.121-3))
SYNCHROCYCLOTRONS
beam energy spread of, reduction of, 18: 26177
use for production of plutonium tracer, optimum conditions for, 18: 26169 (NP-13973)
SYNCHROTRONS
beam production at CERN, neutrino, 18: 26165 (BNL-837(p.91-113))
design study of 300-Bev proton, 18: 26170 (UCRL-10869)
shielding for CERN, meson, 18: 26165 (BNL-837(p.91-113))
SYSTEMS FOR NUCLEAR AUXILIARY POWER (SNAP-2)
kinetic and thermal response of 2/10A, computer program for, 18: 26957 (NAA-SR-8414)
SYSTEMS FOR NUCLEAR AUXILIARY POWER (SNAP-10)
kinetic and thermal response of 2/10A, computer program for, 18: 26957 (NAA-SR-8414)

T

TALOSE
oxidation by sodium chlorite tritium kinetic isotope effects in, 18: 25459
TANKS
design for shipping fission products, evaluation of, 18: 25707 (HW-65268 (Rev.1))
leaks in waste-storage, thermal consequences of, 18: 26976 (HW-80848)
testing for fission product shipping, drop, 18: 25708 (HW-77962)
TANTALUM
alloying effects on niobium oxidation, 18: 25936
alloying effects on electric conductivity, hardness, and structure of niobium, 18: 25999
analysis for niobium, spectrophotometric, 18: 25284
book: *Vanadium, Niobium, Tantalum. The Metallurgy of the Pure Metals and Their Alloys*, in German, 18: 25906
determination in plutonium using trioctylamine, emission spectrographic, 18: 25279
electrolytic deposition with nickel, niobium, titanium, and zirconium, 18: 26057
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
evaporation and heat of sublimation, 18: 26015
neutron elastic scattering at 5.0 Mev, angular distributions, 18: 26671
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26671

oxidation at high temperatures, mechanism of, 18: 25934
oxidation by carbon dioxide at 700 to 950°C, kinetics of, 18: 25935
reactions with rare earth borides, 18: 25319 (COO-1140-103)
thermal diffusion at 1300 to 2500°C, 18: 25986 (WADD-TR-60-581(Pt.IV))

TANTALUM ALLOYS
book: *Vanadium, Niobium, Tantalum. The Metallurgy of the Pure Metals and Their Alloys*, in German, 18: 25906
Co–Nb–Ta, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Co–Ta–Ti, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Co–Ta–Zr, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Cr–Mo–Nb–Ta, composition having superior high-temperature strength, 18: 25917(P)
Cr–Mo–Ta, composition having superior high-temperature strength, 18: 25917(P)
Ga–Ta, crystal structure of, 18: 26043(T)
Hf–Ta–W, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Ir–Ta, phase studies, 18: 25988
Pd–Ta, phase studies, 18: 25988
Pd–Ta, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Pt–Ta, phase studies, 18: 25988
Rh–Ta, phase studies, 18: 26048
Rh–Ta, phase studies, 18: 25988
Ta–Ti–V, compatibility with sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Ta–V, phase studies, 18: 26055
Ta–W, fabrication of tubular, 18: 25939(R) (ANL-6868(p.201-18))
Ta–W, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Ta–W–Zr, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))

TANTALUM BROMIDES
reactions with dimethyl- and diphenyl sulfoxides, properties and spectra of products in, 18: 25398

TANTALUM CARBIDES
crystal structure, 18: 25970(R) (ANL-6868(p.303-25))
thermal diffusion at 1300 to 2500°C, 18: 25986 (WADD-TR-60-581(Pt.IV))

TANTALUM CHLORIDES
reactions with dimethyl- and diphenyl sulfoxides, properties and spectra of products in, 18: 25398

TANTALUM ISOTOPES Ta-181
deuteron elastic scattering at 10 Mev, angular distributions for, 18: 26561

TANTALUM OXIDES
analysis for niobium, spectrophotometric, 18: 25284
reactions with tungsten oxide at 1000 and 1200°C, phase studies of products of, 18: 25444

TANTALUM SYSTEMS
C–Ta, phase studies, 18: 26000
H–Ta, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
O–Ta–Ti–Zr, phase studies, 18: 26053
O–Ta–W, phase studies of products of reactions of tantalum and tungsten oxides at 1000 and 1200°C, 18: 25444

TECHNETATES
reduction by hydrochloric acid, 18: 25352

TECHNETIUM ALLOYS
Al–Tc, crystal structure and phase studies, 18: 25970(R) (ANL-6868 (p.303-25))

TECHNETIUM IONS
reduction of septavalent, by hydrochloric acid, 18: 25352

TECHNETIUM ISOTOPES Tc-99
content in pitchblende, 18: 25705

TECHNETIUM SYSTEMS
Si–Tc, crystal structure and phase studies, 18: 25970(R) (ANL-6868 (p.303-25))

TEETH
fluoroscopy of, development of promethium-147 gamma source for, 18: 25234 (SGAE-IB/IA-2/1964)

TELLURIUM
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26668
neutron scattering cross sections at 0.5 to 0.8 Mev, 18: 26571

TELLURIUM ISOTOPES Te-124
energy levels of, 18: 26631

TELLURIUM OXIDES
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374

TEMPERATURE
effects of hypothermia on radiosensitivity of chicken heart cells in tissue cultures, 18: 25204
measurement at surfaces, 18: 26992
measurement in hot gases by thermal neutron scattering, 18: 26157

TERBIUM
determination using Xylenol Orange, spectrophotometric, 18: 25285
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
magnetic moment of ions of, in crystalline state and in solution, 18: 25350
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
spectra in thorium oxide at 100°K, nephelauxetic effects on reflection, 18: 25423

TERBIUM ALLOYS
Dy–Tb, magnetic transition temperatures in, 18: 25980(R) (ORNL-3582 (p.9-10))
Er–Tb, magnetic transition temperatures in, 18: 25980(R) (ORNL-3582 (p.9-10))
Ho–Tb, magnetic transition temperatures in, 18: 25980(R) (ORNL-3582 (p.9-10))
Tb–Tm, magnetic transition temperatures in, 18: 25980(R) (ORNL-3582 (p.9-10))
Tb–Y, magnetic properties of, 18: 25981(R) (ORNL-3582(p.11-16))

TERBIUM ISOTOPES Tb-149
alpha decay of isomeric, 18: 26615

TERBIUM ISOTOPES Tb-151
alpha decay, 18: 26615

TERBIUM ISOTOPES Tb-155
energy levels, 18: 26566

TERBIUM ISOTOPES Tb-157
transition spectra in, Alaga's rules for electromagnetic, 18: 26628

TERBIUM ISOTOPES Tb-159
transition spectra in Alaga's rules for electromagnetic, 18: 26628

TERBIUM NIOBATES
$CaMoO_4$–$TbNbO_4$, preparation and spectra of, 18: 26017
$CaWO_4$–$TbNbO_4$, preparation, luminescent properties, and structure of, 18: 26017

TERBIUM NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

TERBIUM PHOSPHATES
preparation and single crystal growth of ortho-, 18: 25356

TERBIUM SULFATES
reduction of anhydrous, by carbon monoxide, 18: 25427

TERBIUM SYSTEMS
B–C–Tb, phase studies, 18: 25319 (COO-1140-103)

TERPHENYL
radioinduced polarization of fluorescence from, 18: 25594
benzene–terphenyl, luminescence quenching by carbon tetrachloride in, 18: 25563

TETRAZOLIUM COMPOUNDS
triphenyltetrazolium chloride, radiolysis of, 18: 25595

TEXTILES
radioinduced graft polymerization of acrylonitrile and styrene on viscose rayon, solvent effects on, 18: 25476(T) (AEC-tr-6372(p.97-102))
radioinduced graft polymerization of rayon on styrene, conditions for, 18: 25534(T) (AEC-tr-6372(p.593-602))

THALLIUM
melting temperature of, equations for calculating, 18: 25990
neutron elastic scattering at 5.0 Mev, angular distributions, 18: 26671
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26671
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374

THALLIUM ALLOYS
Pb–Tl, surface superconductivity above critical field in, 18: 26480

THALLIUM BROMIDES
nuclear magnetic resonance in, chemical shift in, 18: 25361
THALLIUM CHLORIDES
nuclear magnetic resonance in, chemical shift in, 18: 25361
THALLIUM IODIDES
nuclear magnetic resonance in, chemical shift in, 18: 25361
THALLIUM ISOTOPES
energy levels of odd-mass, internal-conversion, 18: 26630
THALLIUM ISOTOPES TI-201
energy levels of, half life of, 18: 26654
THALLIUM ISOTOPES TI-203
energy levels of, internal-conversion, 18: 26630
energy levels of, half life of, 18: 26654
neutron separation energy for, 18: 26576
THALLIUM ISOTOPES TI-204
therapeutic use of, as beta source for eye inflammations in rabbits, 18: 25097(T) (JPRS-24936)
THALLIUM ISOTOPES TI-205
neutron separation energy for, 18: 26576
THALLIUM NITRATES
nuclear magnetic resonance in, chemical shift in, 18: 25361
THERMAL CAPACITY
calculation of, 18: 25367
THERMAL CONDUCTIVITY
model for superconductor electronic, 18: 26486
of porous sintered materials, 18: 25987(T) (NP-tr-1247)
THERMAL INSULATION
design of tube of, for reactor pressure tubes, 18: 26835(P)
THERMAL PROPERTIES
book: *High-Temperature Materials.* No. 2, *Properties Index,* 18: 26064(T)
THERMAL RADIATION
biological effects of, from atomic explosion, 18: 25722
interference of, by X agent, 18: 26144
THERMAL REACTORS
experiments and theory in, relation between, 18: 26827
THERMAL STRESSES
in anisotropic hollow cylinders, 18: 26116 (WADD-TR-61-72(Vol.XIX))
THERMIONIC CELLS
development for power reactor cores, 18: 26933
magnetron effect from cathodes in plasma diodes in, geometric dependence of, 18: 26256
materials development for in-pile, 18: 26259
properties, 18: 26255
properties of cesium-vapor, using carbide emitters, 18: 26253(R) (GA-4677)
radiation effects on in-pile, 18: 26259
thermoelectric properties of plasma diodes, theory of, 18: 26250 (AD-423086)
THERMOCOUPLES
design of weak link device for breaking cables in reactor, 18: 25766(P)
junction of, fabrication of sheathed insulated, 18: 25765(P)
response time in Thermocoax, 18: 25754
sealing in pressure vessel cover, 18: 26840(P)
use of gold–platinum, in precision measurements of Debye-Scherrer specimens in high-temperature x-ray diffraction, 18: 26109 (LA-2687)
THERMODYNAMIC PROPERTIES
book: *High-Temperature Materials.* No. 2, *Properties Index,* 18: 26064(T)
THERMOELECTRIC CELLS
cathode heating using polonium-210, 18: 25870 (MLM-1154)
development and testing of, 18: 26251(R) (AD-437280)
properties, 18: 26255
THERMOLUMINESCENCE
radioinduced in anthracene, benzene, and naphthalene, factors affecting, 18: 25472(T) (AEC-tr-6372(p.61-74))
radioinduced in dioxane and trioxane, decay and dose effects on, 18: 25473(T) (AEC-tr-6372(p.75-82))
radioinduced in polyethylene, factors affecting, 18: 25471(T) (AEC-tr-6372(p.49-59))
THERMOMETERS
response time of Thermocoax miniature-mantel thermoelement as, 18: 25754
THERMONUCLEAR EXPLOSIONS
effects on farm animals, 18: 25732
radiation belts produced by Soviet 1962 high-altitude, 18: 26188 (SUI-63-37)
THERMONUCLEAR REACTIONS
book: *Thermonuclear Energy,* 18: 26808
conference on, 18: 26694(T) (AEC-tr-5589)
power production by, 18: 26719
THERMONUCLEAR REACTORS
design using plasma accelerators, 18: 26810(P)
electron temperature in Russian beta, 18: 26792
in temperatures in Tokomak, 18: 26708(T) (AEC-tr-5589(p.861-8))
THERMONUCLEAR WEAPONS
sanitation problems following explosion of, 18: 25720
THERMOSTATS
design with high regulation accuracy, for isotopic analysis, 18: 25750 (PAN-459/XVI)
THICKNESS GAGES
design of beta backscatter, for thin films, 18: 25769(P)
design of radiometric beta, for thin metallic films, 18: 25751
design of x-ray analyzer using beta radiation, 18: 25768(P)
THIONYL CHLORIDE
reactions with irradiated polypropene in carbon tetrachloride, 18: 25490(T) (AEC-tr-6372(p.197-205))
THIOPHOSPHATES
hydrolysis and isomerization reactions of, tracer studies on, 18: 25337
THIOPHOSPHORYL CHLORIDE
chlorine isotopic exchange with tetraethylammonium chloride, 18: 25441
THORIUM
content in marine rocks in Israel, 18: 25686
content in underground waters of Egyptian oil fields, 18: 25696
crystal structure, 18: 25966(R) (ANL-6868(p.120-32))
determination of, use of quinizarine sulfonic acid as chelatochrome indicator in, 18: 25292
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
neutron elastic scattering at 5.0 Mev, angular distributions, 18: 26671
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26671
neutron resonance integrals for, measurement of, 18: 26621
performance in fast reactors, 18: 26824(R) (ANL-6885)
production by fusion electrolysis, 18: 25913(P)
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
separation from magnesium–thorium alloys by precipitation using lithium, 18: 25904
separation from uranium by precipitation from organic solutions of nitrates, 18: 25627(P)
sintering processes at 830 to 1420°C, 18: 25951
sorption from hydrochloric and nitric acid systems with ethanol and isopropanol by ion exchange, 18: 25383
uses in electric power production by reactors, economics of, 18: 26917 (DM-72)
THORIUM ALLOYS
Mg–Th, separation of thorium from, using liquid lithium, 18: 25904
Pu–Th–U, crystal structure and phase studies, 18: 25966(R) (ANL-6868(p.120-32))
Th–U, crystal structure and phase studies, 18: 25966(R) (ANL-6868(p.120-32))
Th–U, fabrication by extrusion, 18: 25939(R) (ANL-6868(p.201-18))
THORIUM CARBIDES
crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
NpC–ThC, crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
PuC–ThC, crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
ThC–UC, crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
THORIUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
THORIUM COMPLEXES
with β-hydronaphthazarin and naphthazarin, formation constants and spectra of, 18: 25456

with dialkyl phosphoric acids, preparation and properties, 18: 25429
THORIUM ISOTOPES Th-232
contribution to gamma radioactivity of earth, 18: 25694
fission by helium ions at energies up to 40 Mev, product yields, 18: 26670
THORIUM NITRATES
preparation from uranothoriante ores, process for, 18: 25617
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
THORIUM ORES
processing, 18: 25617
THORIUM OXALATES
preparation, 18: 25627(P)
THORIUM OXIDES
activation and poisoning of emitters coated with, 18: 25752
spectra of, rotational band, 18: 25407
THORIUM(IV) OXIDES
deposition in human bone marrow, 18: 25076
effects on bilirubin content of lymph and serum of dogs, 18: 25060
effects on ultrastructure of the liver in lizards and fish, 18: 25066
friction factors of suspensions of, measurement and correlation at high temperature of turbulent, 18: 25659
liver tumors induced by, 18: 25205
pathological effects of injected, in rats, 18: 25065
pathological effects of injected Thorotrast, delayed effects in man, 18: 25147
spectra of lanthanides in, nephelauxetic effects on reflection, 18: 25423
PuO_2–ThO_2, preparation and properties of spherical particles of, 18: 26008
ThO_2–UO_2, dissolution in hydrofluoric acid–nitric acid solutions, 18: 25608 (ORNL-TM-867)
ThO_2–UO_2, radiation effects on fuel particles of electron microscopic studies on, 18: 26081
THORIUM PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
THORIUM PEROXIDES
preparation and properties of, from chloride solutions, 18: 25440
THORIUM PHOSPHATES
preparation and fluorescence properties of copper-activated, 18: 25376
preparation and properties of gels of, 18: 25415
THORIUM PHOSPHIDES
preparation and properties, 18: 26896(R) (ANL-6868(p.133-74))
THORIUM SILICATES
preparation of hydrosols of, 18: 25447(P)
THORIUM SULFATES
preparation, 18: 25627(P)
THULIUM
determination using Xylenol Orange, spectrophotometric, 18: 25285
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
spectra in thorium oxide at 100°K, nephelauxetic effects on reflection, 18: 25423
THULIUM ALLOYS
Tb–Tm, magnetic transition temperatures in, 18: 25980(R) (ORNL-3582 (p.9-10))
Tm–Y, magnetic properties of, 18: 25981(R) (ORNL-3582(p.11-16))
THULIUM IONS
radioinduced luminescence in calcium fluoride crystals, gamma, 18: 25571(T)
THULIUM ISOTOPES Tm-166
decay scheme of, beta- and gamma-, 18: 26632
THULIUM NIOBATES
fluorescence spectra, 18: 26017
$CaMoO_4$–$TmNbO_4$, preparation and spectra of, 18: 26017
$CaWO_4$–$TmNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
THULIUM TANTALATES
fluorescence spectra, 18: 26017
THYMIDINE
uptake by mouse testes of tritiated, dose-effect measurements of, 18: 25069
THYMINE
effects of *E. coli* deprivation of, on uv injury dark repair, 18: 25221
THYMUS
surgical removal of mouse, effects on immunological tolerance, 18: 25157
THYROID DISEASES
diagnosis of, effects of thyroidal iodine-131 uptake on, 18: 25237
THYROID GLAND
deposition of iodine-131-labeled fibrinogen in, in rats, 18: 25068
iodine-131 uptake by human, problems from, 18: 25237
radiodiagnosis of tumors in, development of scintillation camera for, 18: 25236
TIME MEASUREMENT
quantum theory of, hermitian operator in, 18: 26433
TIMING CIRCUITS
design for linear amplifier, 18: 25799 (NAS-NRC-Pub-1184(p.124-34))
development of transistorized high-resolution analyzer, 18: 25753
TIN
deposition on niobium–zirconium alloy by slurry dip and spray method, 18: 25896(R) (PF-63-3)
energy gap in superconducting film of, 18: 26487
gamma buildup factors for, 0.5- to 10-Mev, 18: 26814(T) (ORNL-tr-80)
gamma scattering at 662 kev, Rayleigh, 18: 26292
neutron elastic scattering at 0.5 to 0.8 Mev, cross sections for, 18: 26568
preparation, properties, and uses of thin-film superconductors of, 18: 26476
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
superconducting films of, edge-effect suppression in, 18: 26482
surface impedance of superconducting, at 3B cps, 18: 26467
TIN ALLOYS
Al–Mo–Sn–Zr, corrosion by sodium, 18: 25937
In–Sn, surface impedance of superconducting, 18: 26467
Nb–Sn, critical currents of superconducting, 18: 26464
Nb–Sn, surface impedance in superconducting, 18: 26489
TIN CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
TIN ISOTOPES Sn-112
neutron reactions (n,γ) with, below 200 ev, 18: 26540(R) (ORNL-3582 (p.62-7))
nuclear radius of, 18: 26538(R) (ORNL-3582(p.56-7))
TIN ISOTOPES Sn-114
neutron reactions (n,γ) with, below 200 ev, 18: 26540(R) (ORNL-3582 (p.62-7))
nuclear radius of, 18: 26538(R) (ORNL-3582(p.56-7))
TIN ISOTOPES Sn-115
neutron reactions (n,γ) with, below 200 ev, 18: 26540(R) (ORNL-3582 (p.62-7))
TIN ISOTOPES Sn-116
neutron reactions (n,γ) with, below 200 ev, 18: 26540(R) (ORNL-3582 (p.62-7))
nuclear radius of, 18: 26538(R) (ORNL-3582(p.56-7))
TIN ISOTOPES Sn-117
neutron reactions (n,γ) with, below 200 ev, 18: 26540(R) (ORNL-3582 (p.62-7))
nuclear radius of, 18: 26538(R) (ORNL-3582(p.56-7))
TIN ISOTOPES Sn-118
helium-3 elastic scattering at 20 Mev, differential cross sections, 18: 26681
neutron reactions (n,γ) with, below 200 ev, 18: 26540(R) (ORNL-3582 (p.62-7))
neutron scattering by, optical model calculations of cross sections for, 18: 26663
nuclear radius of, 18: 26538(R) (ORNL-3582(p.56-7))
TIN ISOTOPES Sn-119
internal conversion in, coefficients for, 18: 26642
neutron reactions (n,γ) with, below 200 ev, 18: 26540(R) (ORNL-3582 (p.62-7))
nuclear radius of, 18: 26538(R) (ORNL-3582(p.56-7))

TIN ISOTOPES Sn-120
neutron reactions (n,γ) with, below 200 ev, 18: 26540(R) (ORNL-3582 (p.62-7))
nuclear radius of, 18: 26538(R) (ORNL-3582(p.56-7))
TIN ISOTOPES Sn-122
neutron reactions (n,γ) with, below 200 ev, 18: 26540(R) (ORNL-3582 (p.62-7))
nuclear radius of, 18: 26538(R) (ORNL-3582(p.56-7))
TIN ISOTOPES Sn-124
neutron reactions (n,γ) with, below 200 ev, 18: 26540(R) (ORNL-3582 (p.62-7))
nuclear radius of, 18: 26538(R) (ORNL-3582(p.56-7))
TIN ISOTOPES Sn-128
separation from fission products by solvent extraction using TTA, 18: 25274
TISSUE CULTURES
radiation effects on HeLa, tritium, 18: 25156
radiosensitivity of cells in, effects of hypothermia on, 18: 25204
radiosensitivity of HeLa cells, effects of dose rate on, 18: 25187
TISSUES
analysis of muscle, liver, kidney, spleen, intestine, fat, and bone marrow for carbon, hydrogen, nitrogen, and oxygen content, 18: 25048
cell multiplication in, computer analysis of, 18: 26982(R) (NYO-2462-1)
neutron dosimetry, problems of fast, 18: 25107
photodynamic reactions in, 18: 26983 (NYO-2734-1)
radiation effects on homologous grafts of rat skin, x, 18: 25114
radiation effects on survival of rat skin homograft, beta, 18: 25112
radiation effects on respiration in tumor, 18: 25168
radiosensitivity of, effects of dose fractionation on, 18: 25192
TITANIUM
alloying effects on niobium oxidation, 18: 25936
alloying effects on electric conductivity, hardness, and structure of niobium, 18: 25999
alloying effects on corrosion properties of types 405 and 406 stainless steel, 18: 26894(R) (ANL-6868(p.109-16))
corrosion by mercury at 1000°F, effects of nickel inhibitors on, 18: 25919(R) (ANL-6868(p.190-200))
crystal structure and phase studies, 18: 25968(R) (ANL-6868(p.267-86))
deposition on niobium–zirconium alloy by fused salt bath method, 18: 25896(R) (PF-63-3)
determination in molybdenum alloys, plasma arc technique for spectrochemical, 18: 25268 (ML-TDR-64-36)
determination in tungsten, spectrophotometric, 18: 25281
diffusion into liquid iron at 1923°K, 18: 26010
elastic properties at 4 to 1200°K, 18: 25968(R) (ANL-6868(p.267-86))
electrolytic deposition with nickel, niobium, tantalum, and zirconium from anhydrous solutions, 18: 26057
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
production by fusion electrolysis, 18: 25913(P)
properties for construction of high-temperature ionization chambers, 18: 25776 (AEEW-M-381)
TITANIUM ALLOYS
Co–Ta–Ti, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Cr–Cu–Fe–Mo–Ni–Ti, corrosion and fabrication properties for use as nuclear fuel reprocessing plant dissolver, 18: 25996
Mo–Nb–Ti, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Mo–Nb–Ti, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Mo–Ti–Zr, performance as coating on fast reactor fuel elements, 18: 26824(R) (ANL-6885)
Mo–Ti–Zr, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Nb–Ti, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Ti, flux jumping and training in superconducting solenoids of, 18: 26470
Nb–Ti–V, compatibility with sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Nb–Ti–V, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Ti–Zr, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Ti–Zr, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Ta–Ti–V, compatibility with sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Ti–V, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Ti–V, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Ti–V, performance as coating on fast reactor fuel elements, 18: 26824(R) (ANL-6885)
Ti–V, tensile properties at 20 to 800°C, 18: 25966(R) (ANL-6868 (p.120-32))
Ti–V–Zr, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Ti–Zr, creep of beta, 18: 26011
TITANIUM CARBIDES
crystal structure, 18: 25970(R) (ANL-6868(p.303-25))
thermal conductivity and diffusion, 18: 25986 (WADD-TR-60-581(Pt.IV))
TITANIUM CHLORIDES
effects on radioinduced polymerization of ethylene, 18: 25508(T) (AEC-tr-6372(p.387-95))
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
TITANIUM COMPLEXES
with β-hydronaphthazarin and naphthazarin, formation constants and spectra of, 18: 25456
TITANIUM ISOTOPES Ti-47
deuteron reactions (d,αn), (d,n), (d,2n), and (d,2p) at 4 to 20 Mev, excitation functions for, 18: 26649
interactions of, ESR of vanadium-4+ and manganese-4+ in rutile from hfs, 18: 25411
TITANIUM ISOTOPES Ti-49
interactions of, ESR of vanadium-4+ and manganese-4+ in rutile from hfs, 18: 25411
TITANIUM NITRIDES
thermal conductivity, 18: 25986 (WADD-TR-60-581(Pt.IV))
TITANIUM OXIDES
analysis for scandium-46 to -48 ratio in targets of, spectrometric, 18: 25298
iron group ion ESR in, 18: 25411
thermodynamics of nonsubstitutional solid solutions of, statistical model for, 18: 25421
H–O–Ti, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
TITANIUM STEEL
Cr–Ni–Ti–W, analysis of carbide phase isolated from, activation, 18: 25289
TITANIUM SYSTEMS
O–Ta–Ti–Zr, phase studies, 18: 26053
TITRATION EQUIPMENT
development of graphite electrodes for, 18: 25320 (COO-1148-84)
TOLUENE
effects on yields in radiolysis of α- and p-toluenethiol, 18: 25549
radiation effects on, ESR spectra of, 18: 25520(T) (AEC-tr-6372(p.481-90))
radioinduced polymerization with dimethylketene, products and reactivity of, 18: 25494(T) (AEC-tr-6372(p.237-46))
radiolysis of sulfur compounds in, energy transfer in, 18: 25548
CS_2–S–toluene, radiolysis of, formation of sulfur compounds in, 18: 25547
cyclohexane–S–toluene, radiolysis of, formation of sulfur compounds in, 18: 25547
S–toluene, radiolysis of, formation of sulfur compounds in, 18: 25547
TOLUENE, VINYL- POLYMERS
radioinduced polymerization of, activation energy and kinetics of, 18: 25503(T) (AEC-tr-6372(p.331-47))
use in scintillating organic anion exchange resin, 18: 25259 (NYO-10405)
α-TOLUENETHIOL
formation in radiolysis of toluene–sulfur solutions, 18: 25547
radiolysis in toluene solutions, energy transfer in, 18: 25548
radiolysis of, solvent effects on mechanism of, 18: 25549
p-TOLUENETHIOL
radiolysis in toluene solutions, energy transfer in, 18: 25548
radiolysis of, solvent effects on mechanism of, 18: 25549
TOPOPAH SPRING SW QUADRANGLE (NEV.)
geologic map, 18: 26986 (TEI-846)
TOWER SHIELDING FACILITY

shielding experiments with suspended compartmentalized shelters, 18: 25712 (USNRDL-TR-722)
TRACER TECHNIQUES
industrial uses of, radiation protection in, 18: 25725
TRACER TECHNIQUES (BIOLOGY)
theory of, 18: 25052
TRACER TECHNIQUES (BOTANY)
uses in studies of flowering and nectar formation in linden trees, 18: 25058(T) (OTS-63-11008(p.1-5))
TRACER TECHNIQUES (ENGINEERING)
uses in studies of mixing processes for cement in pneumatic mixing silo with 1000 m^3 capacity, 18: 25871 (SGAE-IB/IA-1/1964)
TRACER TECHNIQUES (GEOLOGY)
groundwater hydrology using tritium, 18: 25701
method for simultaneous tracer and natural gamma logging, 18: 25703(P)
uses of tritium in, for ground-water flow studies, Eddy County, New Mexico, 18: 25684 (TEI-839)
TRACER TECHNIQUES (MEDICINE)
for cerebral blood circulation measurements, comparison of, 18: 25043
for demonstration of hematopoietic marrow in patients with blood dyscrasias or cancer, radioisotope scanning method, 18: 25238
for study of blood circulation in heart of anesthetized dogs, 18: 25040
measurement of intestinal absorption of iron-59 in man, comparison of whole-body counting and fecal recovery methods for, 18: 25072
preparation and use of iodine-132 in, 18: 25039 (BLG-44)
theory of, 18: 25052
use for liver and kidney function tests, 18: 25050
use of krypton-85 to measure blood circulation in heart, 18: 25042
TRANSFORMERS
design for measuring large d-c currents, 18: 26997(P)
layout of superconducting, 18: 26466
TRANSISTORS
radiation effects at 40 and 440 Mev on germanium and silicon, proton, 18: 26091
radiation effects on field-effect, 1-Mev electron, 18: 25741 (N64-13153)
radiation effects on, 1-Mev electron, 18: 25741 (N64-13153)
radiation effects on secondary breakdown in, neutron, 18: 25756
use of field-effect, in charge-sensitive amplifier circuits, 18: 25791 (NAS-NRC-Pub-1184(p.70-8))
use of field-effect, in preamplifiers, 18: 25812 (NAS-NRC-Pub-1184 (p.204-6))
TRANSITION METALS
diffusion and solubility in alkali metals, development of equipment and methods for studying, 18: 25314(R) (AI-64-75)
magnetism and superconductivity in, 18: 26475
TRAPS
design of high vacuum liquid-nitrogen, 18: 26999(P)
TREES
flowering and nectar formation in linden, tracer studies of, 18: 25058(T) (OTS-63-11008(p.1-5))
s-TRIAZINE, 2,4,6-TRIS-(ALLYLOXY)-
radioinduced polymerization with polyvinyl chloride, 18: 25569
TRIETHYLAMINE
effects on dielectric properties of butyllithium, 18: 25452
radioinduced crosslinking reactions with epoxy resin, hardening in, 18: 25528(T) (AEC-tr-6372(p.539-46))
TRIOCTYLAMINE
solvent properties for plutonium, 18: 25279
TRIOXANES
radiation effects on ESR spectra of, comparison of polyoxymethylene to, 18: 25516(T) (AEC-tr-6372(p.455-8))
radioinduced polymerization of, kinetics of post-, 18: 25500(T) (AEC-tr-6372(p.299-310))
radioinduced polymerization of, crystal structure of polymers produced in, 18: 25501(T) (AEC-tr-6372(p.311-21))
radioinduced polymerization of solid, epitaxy in, 18: 25502(T) (AEC-tr-6372(p.323-30))
radioinduced polymerization of, activation energy and kinetics of, 18: 25503(T) (AEC-tr-6372(p.331-47))
radioinduced thermoluminescence in, decay and dose effects on, 18: 25473(T) (AEC-tr-6372(p.75-82))
TRITIUM
determination in form of hydrocarbon and water using liquid scintillation detector, 18: 25301
determination in tritiated water, correction factor for, 18: 25309
determination of, efficiency use of glass fibers for liquid scintillation, 18: 25839
diffusion through neoprene and polyvinyl chloride, 18: 25706 (AWRE-O-17/62)
incorporation into linoleic acid, 18: 25077
lifetime of hyperfragment ($_{\Lambda}H^3$), 18: 26527 (BNL-837(p.454-6))
neutron flux measurements of T(d,n) reaction, 18: 26590
production in californium-252 spontaneous fission, 18: 26644
proton reactions (p,n), threshold energy for, 18: 26616
proton reactions (p,n), resonances in, 18: 26672
sorption by zirconium, use as radiation source in x-ray fluorescent instrument, 18: 25275
tracer uses in groundwater age measurements, 18: 25701
uses as ground-water tracer between Lake McMillan and Major Johnson Springs, Eddy County, New Mexico, 18: 25684 (TEI-839)
TRITONS
angular distributions in oxygen-16 (p,t) reactions, 18: 26653
binding energy in $^5He_{\Lambda}$, 18: 26591
TROPOLONES
isopropyl-, solvent properties for americium and europium, 18: 25622
TUBES
development and fabrication of refractory metal, 18: 25939(R) (ANL-6868(p.201-18))
fabrication of tungsten and tungsten–rhenium, 18: 25894(R) (NMI-2128)
fluid flow in entrance region of, analysis of laminar, 18: 25668
heat transfer in vapor-heated, with arbitrary timewise-variant flow perturbation, 18: 25664
wall inspection of, pulsed electromagnetic system for, 18: 25674 (ANL-6728)
welding to tube sheet, apparatus for, 18: 25961(P)
TUMORS
chemotherapy of, effects of autologous bone marrow transfusions on results of, 18: 25220
deposition of iodine-131-labeled fibrinogen in, in rats, 18: 25068
desoxyribonucleic acid synthesis in mouse, effects of x radiation and radiomimetic drug on, 18: 25166
desoxyribonucleic acid synthesis in mouse, effects of x radiation and radiomimetic drug on, 18: 25173
distribution of hematopoietic marrow in, demonstrated by radioisotope scanning, 18: 25238
effects of, on erythropoietin content of blood, 18: 26988 (TID-20635)
effects on rubidium-86 uptake by erythrocytes, 18: 25074
fibrin synthesis in rat, effects of enzymes and fibrinolysin inhibitors on, 18: 25068
incidence of, in aged irradiated dogs, 18: 25093(R) (UCD-472-109(p.62-172))
radiation effects on development of transplanted, in rats, 18: 25197
radiation effects on growth and development of metastases from transplanted, in mice, 18: 25162
radiation effects on respiratory activity in, 18: 25168
radiodiagnosis of brain, kidney, liver, and thyroid, development of scintillation camera for, 18: 25236
radioinduced in human liver by Thorotrast, 18: 25205
radioinduced in skin, 18: 25081 (AHSB(RP)R-39(p.21-9))
radioinduced, of barley leaves, 18: 25178
radiosensitivity of HeLa cells, effects of dose rate on, 18: 25187
radiotherapy of Hodgkin's disease, time-dose relations for, 18: 25251
radiotherapy of lung, 18: 25240
radiotherapy of malignant, in man using gamma unit, 18: 25254
radiotherapy of urinary bladder, results of massive doses of gamma radiation in, 18: 25244
radiotherapy of, effects of autologous bone marrow transfusions on results of, 18: 25220
silica-induced, in rats, 18: 25053
strontium-induced, in rats, 18: 25053
therapeutic effects of semicarbazide-cadmium on malignant, in man, 18: 25054
TUNGSTEN
activation and poisoning of thoria-coated filament emitters of, 18: 25752

alloying effects on electric conductivity, hardness, and structure of niobium, 18: 25999
analysis for molybdenum, titanium, and zirconium traces, spectrophotometric, 18: 25281
casting methods for, 18: 25954
deposition and nucleation of silver on, field-emission microscopy of, 18: 26054
diffusion into liquid iron at 1923°K, 18: 26010
diffusion of oxygen in, thermodynamics of, 18: 26035
electric conductivity of cold-worked, recovery of, 18: 25993
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
exploding wire phenomena in, plasma production in underwater, 18: 26754
fabrication and properties of sheet, from granules, 18: 25950
fabrication into plates and sheets, 18: 25944(R) (N63-14854)
fabrication of tubing of, by extrusion and drawing, 18: 25894(R) (NMI-2128)
fabrication of tubular, by extrusion, 18: 25939(R) (ANL-6868(p.201-18))
gamma buildup factors for, 0.5- to 10-Mev, 18: 26814(T) (ORNL-tr-80)
gamma scattering at 662 kev, Rayleigh, 18: 26292
melting temperature of, equations for calculating, 18: 25990
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26671
oxide coating formation on, by anodic polarization in nitric acid, 18: 25404
properties of arc plasma-sprayed, effects of sintering on, 18: 26046
properties of cast, 18: 25954
reactions with fluorine, effects of form on rate of, 18: 25332(T) (UCRL-Trans-1044(L))
reactions with rare earth borides, 18: 25319 (COO-1140-103)
Schottky deviations in photoelectric and thermionic emissions by single crystal of, 18: 26161
separation of molybdenum from, by reversed-phase chromatography using hydrochloric and sulfuric acids, 18: 25280
tensile properties of, sonic measurements of, 18: 26824(R) (ANL-6885)
thermal diffusion at 1300 to 2500°C, 18: 25986 (WADD-TR-60-581(Pt.IV))

TUNGSTEN ALLOYS
Fe–W, diffusion into liquid iron at 1923°K, 18: 26010
Hf–Re–W, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Hf–Ta–W, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Mo–Nb–W–Zr, homogenization kinetics of sintered, 18: 26047
Mo–Nb–W–Zr, homogenization kinetics of sintered, 18: 26052
Mo–Os–W, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Mo–W, casting methods for, 18: 25954
Mo–W, mechanical and physical properties of cast, 18: 25954
Nb–W–Zr, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Pd–W, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Pd–W, phase studies at 1100 to 1815°C, 18: 26023
Re–W, fabrication of tubing of, by extrusion and drawing, 18: 25894(R) (NMI-2128)
Re–W, properties, 18: 25976 (NMI-1261)
Ru–W, phase studies, 18: 26045
Ta–W, fabrication of tubular, 18: 25939(R) (ANL-6868(p.201-18))
Ta–W, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Ta–W–Zr, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))

TUNGSTEN CARBIDES
Co–WC, tensile properties, 18: 26004

TUNGSTEN ELECTRODES
performance in thermionic cells, 18: 26933
use of yttrium-coated, for arc-melting refractory metals, 18: 25918(P)

TUNGSTEN ISOTOPES W-182
neutron resonance absorption by, at 4.2 and 21.1 ev, 18: 26539(R) (ORNL-3582(p.58-60))

TUNGSTEN ISOTOPES W-183
neutron resonance absorption by, at 7.7 and 27.1 ev, 18: 26539(R) (ORNL-3582(p.58-60))
transition spectra in, Alaga's rules for electromagnetic, 18: 26628

TUNGSTEN ISOTOPES W-186
neutron resonance absorption by, at 18.8 ev, 18: 26539(R) (ORNL-3582(p.58-60))

TUNGSTEN NITRIDES
crystal structure of hexagonal, 18: 26042(T)

TUNGSTEN OXIDES
preparation of coatings of, on tungsten, by anodic polarization in nitric acid, 18: 25404
reactions with tantalum oxide at 1000 and 1200°C, phase studies of products of, 18: 25444

TUNGSTEN STEEL
Cr–Ni–Ti–W, analysis of carbide phase isolated from, activation, 18: 25289

TUNGSTEN SYSTEMS
O–Ta–W, phase studies of products of reactions of tantalum and tungsten oxides at 1000 and 1200°C, 18: 25444

TURBINES
exhaust wetness reduction in, 18: 25660
materials development for, 18: 26946
use of gas, carrier to reactor cycle as auxiliary in BWR plants as heat carrier to reactor cycle, 18: 26942

U

ULTRASONICS
attenuation of, effects of coulomb interaction on, 18: 26408
imaging for nondestructive testing, 18: 25675(R) (ANL-6868(p.219-28))

ULTRAVIOLET RADIATION
biological effects on *E. coli*, mechanism of cross-induction, 18: 25210
biological effects on erythropoiesis in rats, 18: 25160
chemical effects on halogen-substituted uracil in DNA, 18: 25593
effects on *E. coli*, dark repair during thymine deprivation of, 18: 25221
effects on ESR spectra of beta irradiated cyclohexene, 18: 25523(T) (AEC-tr-6372(p.495-8))
effects on ESR spectra of beta irradiated 1-hexadecyne, 18: 25524(T) (AEC-tr-6372(p.499-501))
effects on reflectance of paint systems for space vehicles, 18: 26097
effects on viability of skin grafts, 18: 25113
polymerization of β-propiolactone induced by, 18: 25499(T) (AEC-tr-6372(p.291-7))
production of color centers in samarium-doped calcium fluoride, 18: 26086

UNITED KINGDOM ATOMIC ENERGY AUTHORITY
mass spectrometer and isotope separator facilities at, 18: 25740 (EANDC(UK)-25L)

URACIL, 5-BROMO-
radioinduced changes in, in DNA, 18: 25593

URACIL, 5-CHLORO-
radioinduced changes in, in DNA, 18: 25593

URACIL, 5-IODO-
radioinduced changes in, in DNA, 18: 25593

URANIUM
analysis for trace impurities, bibliography on, 18: 25263 (AWRE/Lib/Bib/8)
analysis for trace amounts of cadmium, chromium, cobalt, iron, manganese, and molybdenum, bibliography on, 18: 25272 (VDDIT-90)
bonding to ferrous metals, 18: 25962(P)
book: *Nuclear Energy*, 18: 26241
coating with magnesium films, 18: 25911(P)
compatibility with Armco iron and type 304 stainless steel to 1300°C, 18: 26893(R) (ANL-6868(p.11-108))
content in marine rocks in Israel, 18: 25686
corrosion by sodium at 200 to 400°C, 18: 25937
corrosion by water vapor at 100°C in absence of oxygen, effects of vapor pressure on, 18: 25921 (AWRE-O-25/64)
crystal grain sizes in, measurement of, 18: 25269(R) (NLCO-905)
crystal structure of, detection of preferred orientation in, 18: 25269(R) (NLCO-905)
crystal structure of, effects of working on, 18: 25269(R) (NLCO-905)
deformation in single crystals of β, mechanism of, 18: 26029
determination in ratio with lead in allanite from Bankura District, India, x-ray fluorescence, 18: 25704
determination in zirconium alloys, fluorometric, 18: 25283
development as structural material, review on engineering and metallurgical, 18: 25901
diffusion of chromium, cobalt, copper, iron, manganese, nickel, and niobium in gamma, 18: 25969(R) (ANL-6868(p.287-302))

dissolution of fuel elements of, apparatus for, 18: 26903
dissolution of irradiated, equipment and methods for, 18: 25610 (SGAE-CH-4/1964)
effects on properties of carbon steel, 18: 26044
elastic properties of monocrystalline alpha, to 1000°K, 18: 25967(R) (ANL-6868(p.231-3))
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
fabrication and properties as reactor fuel, 18: 26893(R) (ANL-6868 (p.11-108))
fabrication of rods and tubes by rolling, 18: 25940 (BMI-X-294)
gamma buildup factors for, 0.5- to 10-Mev, 18: 26814(T) (ORNL-tr-80)
gas release and swelling in, model for, 18: 26080
hydrogen content in fabricated, effects of processing methods on, 18: 25943 (HW-30116)
neutron diffusion in blocks of, 18: 26521
neutron elastic scattering at 0.5 to 0.8 Mev, cross sections for, 18: 26568
neutron elastic scattering at 5.0 Mev, angular distributions, 18: 26671
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26671
preparation at French Maluesi plant, 18: 25618
preparation by reduction of uranium hexafluoride, 18: 25403
preparation of, analytic difficulties in, 18: 25619
preparation of, installations and techniques for, 18: 25899
processing, review on methods for, 18: 25901
production by fusion electrolysis, 18: 25913(P)
production of ingots by magnesiothermy and calciothermy, 18: 25899
production of powder of, in pulsed fluidized bed of hydride, 18: 25916(P)
purification by electrorefining of lithium chloride–potassium chloride–uranium(III) chloride at 450 to 500°C, 18: 25399
radiation effects on, bibliography on, 18: 26072 (VDDIT-16(4.2))
separation by ion exchange in organic solvents containing organic acids, 18: 25305
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
separation by solvent extraction using mono-2,4-diethyloctylorthophosphoric acid, 18: 25623
separation from neptunium, plutonium and other elements by ion exchange, 18: 25295
separation from other metals by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
separation from reactor fuels, fluoride-volatility, 18: 26824(R) (ANL-6885)
separation from thorium by precipitation from organic solutions of nitrates, 18: 25627(P)
separation from zirconium alloys using bromomandelic acid, 18: 25283
solvent partition between benzene solutions of benzyl- and cyclohexylalkylamines and nitric acid, 18: 25621
sorption from hydrochloric and nitric acid systems with ethanol and isopropanol by ion exchange, 18: 25383
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
swelling during postirradiation annealing, effects of burnup and grain size on, 18: 26069(R) (ANL-6868(p.373-417))
tensile properties of beta, effects of strain rate and temperature on, 18: 26031
tensile properties, 18: 25894(R) (NMI-2128)
uses in electric power production by reactors, economics of, 18: 26917 (DM-72)

URANIUM ALLOYS

compatibility with refractory alloys and metals, 18: 26893(R) (ANL-6868 (p.11-108))
development of splatcooled slis, 18: 25894(R) (NMI-2128)
fabrication of rods and tubes by rolling, 18: 25940 (BMI-X-294)
radiation effects on, bibliography on, 18: 26072 (VDDIT-16(4.2))
separation from uranium, fluoride-volatility, 18: 26824(R) (ANL-6885)
Al–Fe–U, fabrication for minimum irradiation growth, 18: 25910(P)
Al–Fe–U, radioinduced dimensional changes, 18: 25910(P)
Al–U, dissolution by mercuric nitrate–nitric acid, 18: 25269(R) (NLCO-905)
Fe–Pu–U, properties as zero-power reactor fuels, 18: 26824(R) (ANL-6885)
Fe–U, compatibility with Armco iron at 740 to 1300°C, 18: 26893(R) (ANL-6868(p.11-108))
fissium–U, compatibility with type 304 stainless steel to 1200°C, 18: 26893(R) (ANL-6868(p.11-108))
fissium–Pu–U, fabrication and properties as reactor fuel, 18: 26893(R) (ANL-6868(p.11-108))
fissium–Pu–U, performance as fast reactor fuels, 18: 26824(R) (ANL-6885)
Mo–Pu–U, phase studies, 18: 26893(R) (ANL-6868(p.11-108))
Mo–Pu–U, properties as zero-power reactor fuels, 18: 26824(R) (ANL-6885)
Mo–U, dissolution of irradiated, equipment and techniques for, 18: 25610 (SGAE-CH-4/1964)
Mo–U, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Mo–U, media for dissolution of, 18: 26903
Mo–U, phase deformation in, mechanism of alpha- and gamma-, 18: 26027
Mo–U, tensile properties of quenched, 18: 26026
Pd–U, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Pu–Th–U, crystal structure and phase studies, 18: 25966(R) (ANL-6868 (p.120-32))
Pu–U, compatibility with niobium at 550 to 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Pu–U, fabrication and properties as reactor fuel, 18: 26893(R) (ANL-6868(p.11-108))
Pu–U, oxidation by air at 24°C, effects of aluminum, carbon, copper, iron, molybdenum, and zirconium additions on, 18: 26893(R) (ANL-6868(p.11-108))
Pu–U, performance as fast reactor fuels, 18: 26824(R) (ANL-6885)
Pu–U, phase studies, 18: 26893(R) (ANL-6868(p.11-108))
Pu–U, properties as zero-power reactor fuels, 18: 26824(R) (ANL-6885)
Th–U, crystal structure and phase studies, 18: 25966(R) (ANL-6868 (p.120-32))
Th–U, fabrication by extrusion, 18: 25939(R) (ANL-6868(p.201-18))
U–Zr, bonding to ferrous metals, 18: 25962(P)
U–Zr, separation of uranium from, using bromomandelic acid, 18: 25283

URANIUM CARBIDES

crystal structure and phase studies, 18: 25970(R) (ANL-6868(p.303-25))
density of, sintering temperature effects on, 18: 26059
diffusion of fission products from coated and uncoated, 18: 25983 (SGAE-ME-1/1964)
oxidation of powdered, use of gold as heat dispersant in, 18: 25420
production of dense, using iron additions, 18: 25963(P)
properties as thermionic emitters for cesium-vapor cells, 18: 26253(R) (GA-4677)
properties of, chemical and mechanical, 18: 26060
radiation effects on, bibliography on, 18: 26072 (VDDIT-16(4.2))
thermal capacity, 18: 26896(R) (ANL-6868(p.133-74))
Cr–Fe–UC, phase studies, 18: 26058
Fe–UC, corrosion by carbon dioxide, 18: 26059
Fe–UC, mechanical properties of skull-cast, 18: 26059
PuC–UC, burnup testing of type 304 stainless steel-clad, 18: 26893(R) (ANL-6868(p.11-108))
PuC–UC, preparation and properties as reactor fuel, 18: 26896(R) (ANL-6868(p.133-74))
PuC–UC, production, 18: 26893(R) (ANL-6868(p.11-108))
ThC–UC, crystal structure and phase studies, 18: 25970(R) (ANL-6868 (p.303-25))
UC–US, crystal structure and phase studies, 18: 26896(R) (ANL-6868 (p.133-74))
UC–US, preparation and properties, 18: 26896(R) (ANL-6868(p.133-74))
UC–ZrC, performance as in-pile thermionic electrodes, 18: 26259
UC–ZrC, properties as thermionic emitters for cesium-vapor cells, 18: 26253(R) (GA-4677)

URANIUM(III) CHLORIDES

LiCl–KCl–UCl_3, purification of uranium by electrorefining of, 18: 25399

URANIUM(IV) CHLORIDES

spectra of, effects of ligand field on energy levels of uranium(IV) in, 18: 25339
thermodynamic properties of, in fused lithium chloride–potassium chloride eutectic, 18: 25340

URANIUM(VI) CHLORIDES

separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

URANIUM COMPLEXES

with EDTA, formation constants and spectra of, 18: 25380

with *N*-hydroxyethyliminodiacetic acid, iminodiacetic acid, and sulfosalicylic acid, equilibrium and stability of, 18: 25391

with substituted 2-(pyridyl) and 2-(quinolyl)-1,3-indanediones, acid dissociation and formation constants of, 18: 25457

URANIUM COMPOUNDS

analysis for trace amounts of cadmium, chromium, cobalt, iron, manganese, and molybdenum, bibliography on, 18: 25272 (VDDIT-90)

URANIUM(IV) FLUORIDES

preparation from uranyl sulfates by reduction and fluorination, 18: 25323 (HW-48782)

preparation of anhydrous, 18: 25448(P)

production from uranium oxides by reduction-fluorination, 18: 25899

URANIUM(VI) FLUORIDES

oxidation to uranium dioxide, 18: 25402

reduction to uranium metal, 18: 25403

URANIUM GLASS

preparation and properties as reactor fuel, 18: 26896(R) (ANL-6868 (p.133-74))

URANIUM HYDRIDES

decomposition to metal powder in pulsed fluidized bed, 18: 25916(P)

URANIUM IONS

energy levels of, spectra of, effects of ligand field in tetrachloride on, 18: 25339

URANIUM ISOTOPES U-233

gamma fission to 16 Mev, cross sections for formation of cesium-134 isomeric pair in, 18: 26585

helium-ion fission at 27 to 42 Mev, cross sections for formation of cesium-134 isomeric pair in, 18: 26585

URANIUM ISOTOPES U-235

determination in absolute air filters, nondestructive, 18: 25270 (NYO-10726)

determination in reactor fuels, radiometric, 18: 25269(R) (NLCO-905)

fission of, alpha angular distribution in ternary, 18: 26557 (PAN-481/I)

helium-ion fission at 27 to 42 Mev, cross sections for formation of cesium-134 isomeric pair in, 18: 26585

neutron fission at low energies, interference effects in cross sections for, 18: 26569

neutron fission of oriented, distributions from, 18: 26554(R) (ORNL-3582(p.121-6))

neutron fission rate ratio to uranium-238, measurement of, 18: 26749

URANIUM ISOTOPES U-238

helium-ion fission at 27 to 42 Mev, cross sections for formation of cesium-134 isomeric pair in, 18: 26585

neutron capture ratio for, chemical determination of epicadmium-to-subcadmium, 18: 26249

neutron fission rate ratio to uranium-235, chemical determination of, 18: 26249

proton fission at 45 and 150 Mev, recoil products from, 18: 26677

URANIUM LEACH RESIDUES

digestion of fluoride-bearing, 18: 25269(R) (NLCO-905)

URANIUM NITRIDES

properties of, chemical and mechanical, 18: 26060

URANIUM ORE PROCESSING PLANTS

analytical control, 18: 25619

denitration processes in, 18: 25342

procedures at Malvesi, France, 18: 25618

recovery of yellow cake dust from drier off-gas, 18: 25629(P)

URANIUM ORES

processing, 18: 25617

processing of, analytic problems in, 18: 25619

processing techniques for, review on, 18: 25616

URANIUM OXIDES

density of, sintering temperature effects on, 18: 26059

diffusion of fission products from coated and uncoated, 18: 25983 (SGAE-ME-1/1964)

dissolution of irradiated, equipment and methods for, 18: 25610 (SGAE-CH-4/1964)

dissolution of, media for, 18: 26903

radiation effects on, bibliography on, 18: 26072 (VDDIT-16(4.2))

reduction in thermal-ion plasma, 18: 25269(R) (NLCO-905)

with dialkyl phosphoric acids, preparation and properties, 18: 25429

Sm_2O_3 corrosion by steam at 650°C and water at 360°C, 18: 25919(R) (ANL-6868(p.190-200))

URANIUM OXIDES (STAINLESS STEEL CLAD)

fabrication by extrusion and sintering, 18: 25942 (GEAP-4556)

URANIUM(IV) OXIDES

activation energy of non-stoichiometric, during sintering, 18: 26030

corrosion by steam at 650°C and water at 360°C, 18: 25919(R) (ANL-6868(p.190-200))

extrusion and sintering, 18: 25942 (GEAP-4556)

fabrication by sintering, removal of organic binders during, 18: 26896(R) (ANL-6868(p.133-74))

oxidation, 18: 26896(R) (ANL-6868(p.133-74))

preparation from uranyl nitrates, 18: 25403

preparation of sintered, process for, 18: 25343

production of sinterable, by reduction, 18: 25899

properties of, chemical and mechanical, 18: 26060

reactions with hydrofluoric acid to form uranium hexafluoride, 18: 25403

reactions with oxides of cerium, dysprosium, europium, gadolinium, and samarium, 18: 26896(R) (ANL-6868(p.133-74))

sintering of, for Brittany Power Reactor EL4, 18: 25900

structure of non-stoichiometric, 18: 25405

thermal conductivity at high fission depletion, effective in-pile, 18: 26073 (WAPD-246)

BeO–UO_2, thermal conductivity at high fission depletion, effective in-pile, 18: 26073 (WAPD-246)

Dy_2O_3–UO_2, corrosion by steam at 650°C and water at 360°C, 18: 25919(R) (ANL-6868(p.190-200))

Eu_2O_3–UO_2, corrosion by steam at 650°C and water at 360°C, 18: 25919(R) (ANL-6868(p.190-200))

Gd_2O_3–UO_2, corrosion by steam at 650°C and water at 360°C, 18: 25919(R) (ANL-6868(p.190-200))

Gd_2O_3–UO_2, crystal structure and phase studies, 18: 26896(R) (ANL-6868(p.133-74))

PuO_2–UO_2, preparation, impurity pickup in hammermilling stage, 18: 25895(R) (NUMEC-2389-3)

PuO_2–UO_2, preparation and properties of spherical particles of, 18: 26008

ThO_2–UO_2, dissolution in hydrofluoric acid–nitric acid solutions, 18: 25608 (ORNL-TM-867)

ThO_2–UO_2, radiation effects on fuel particles of electron microscopic studies on, 18: 26081

UO_2–U_3O_8, sintering of, dilatometric investigation of, 18: 26030

UO_2–ZrO_2, thermal conductivity at high fission depletion, effective in-pile, 18: 26073 (WAPD-246)

URANIUM(IV-VI) OXIDES

oxidation and reduction, 18: 26896(R) (ANL-6868(p.133-74))

separation from plutonium dioxide, fluoride-volatility, 18: 26824(R) (ANL-6885)

UO_2–U_3O_8, sintering of, dilatometric investigation of, 18: 26030

URANIUM(VI) OXIDES

preparation from uranyl nitrates by denitration, 18: 25342

preparation from uranium hexafluoride, 18: 25402

URANIUM PERCHLORATES

separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

URANIUM PHOSPHIDES

fabrication by sintering, removal of organic binders during, 18: 26896(R) (ANL-6868(p.133-74))

oxidation by air and oxygen to 1200°C, 18: 26896(R) (ANL-6868(p.133-74))

preparation and properties, 18: 26896(R) (ANL-6868(p.133-74))

UP–US, phase studies, 18: 26896(R) (ANL-6868(p.133-74))

UP–US, preparation and properties, 18: 26896(R) (ANL-6868(p.133-74))

URANIUM SULFIDES

preparation and properties, 18: 26896(R) (ANL-6868(p.133-74))

properties of, chemical and mechanical, 18: 26060

UC–US, crystal structure and phase studies, 18: 26896(R) (ANL-6868 (p.133-74))

UC–US, preparation and properties, 18: 26896(R) (ANL-6868(p.133-74))

UP–US, phase studies, 18: 26896(R) (ANL-6868(p.133-74))
UP–US, preparation and properties, 18: 26896(R) (ANL-6868(p.133-74))
URANIUM SYSTEMS
Al–Fe–Si–U, fabrication of rods and tubes by rolling, 18: 25940 (BMI-X-294)
Be–C–U, tensile properties of splatcooled, 18: 25894(R) (NMI-2128)
C–Np–U, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
C–U, production of dense, using iron additions, 18: 25963(P)
C–U–Zr, phase studies, 18: 25269(R) (NLCO-905)
H–U, critical mass and uranium density of, involving mutually insoluble compounds, 18: 25324 (K-1609)
O–Pu–U, phase studies, 18: 26060
O–U, phase studies, 18: 26060
URANOTHORIANITES
processing, 18: 25617
URANYL CARBONATES
reduction to uranium(V) and (IV) in sodium carbonate and sodium acid carbonate solutions, 18: 25428
URANYL IONS
ion flotation of, effects of ammonium carbonate concentrations on, 18: 25375
radiation effects on fluorescence spectra of, in cesium uranyl nitrate, 18: 25554
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
URANYL MOLYBDATES
crystal structure of, 18: 26118
URANYL NITRATES
denitration to uranium(VI) oxides, 18: 25342
electric conductivity and structure of, in ethanol, methanol, and propanol solutions, 18: 25394
preparation from uranothorianite ores, process for, 18: 25617
preparation, purification, and decomposition, 18: 25403
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
URANYL TUNGSTATES
crystal structure of, 18: 26118
UREA, THIO-
effects on genetic recombination in Sordaria, 18: 25222
URINE
analysis for plutonium-239, comparison of two extraction methods for, 18: 25299
radiation effects on excretion of adrenal hormones in, of man, 18: 25104
UTAH
fallout uptake by deer and man in, 18: 25693

V

VACCINES
biological effects of Brucella, in irradiated guinea pigs, 18: 25096(T) (JPRS-24896)
VACUUM FURNACES
description of flame, for high-temperature studies on beryllium, 18: 25328(R) (SC-DC-64-864)
VACUUM GAGES
design of ionization-type, 18: 25757
VACUUM PUMPS
book: *Ultrahigh Vacuum, An Introduction*, in German, 18: 25683
VACUUM SYSTEMS
book: *Ultrahigh Vacuum, An Introduction*, in German, 18: 25683
VACUUM TECHNIQUES
at French Pierrelatte gaseous diffusion plant, 18: 25682
VACUUM VESSELS
design for electron beam working of large workpieces, 18: 25964(P)
VALVES
cleaning mass spectrometer, 18: 25269(R) (NLCO-905)
design of leak, for mass spectrometer ion source, 18: 25652(P)
development for superheaters, 18: 26946
VAN ALLEN RADIATION BELTS
beam pulsing system for, design of nanosecond, 18: 26176
charged particle movement in, adelphic-integral method and Stoermer problem for, 18: 26242
charged-particle intensity variations in outer, 18: 26444
electron distribution in outer zone, Explorer XII observations on, 18: 26246
proton-energy spectra in, 18: 26244
VAN DE GRAAFF ACCELERATORS
power fluctuations of, in radiation chemistry studies, 18: 26171(T) (AEC-tr-6372(p.511-20))
use in industrial radiography, exposure curves of two films for, 18: 26175
VANADIUM
book: *Vanadium, Niobium, Tantalum. The Metallurgy of the Pure Metals and Their Alloys*, in German, 18: 25906
compatibility with fissium–plutonium–uranium alloys at 500 and 600°C, 18: 26893(R) (ANL-6868(p.11-108))
current fluctuations in superconducting, 18: 26484
determination in presence of cerium and iron using potassium dichromate, potentiometric, 18: 25308
deuteron scattering by carbon and mercury impurities in, cross sections for, 18: 26560
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
helium-3 elastic scattering at 20 Mev, differential cross sections, 1[illegible]. 26681
oxidation in hydrochloric, nitric, phosphoric, and sulfuric acids and sodium hydroxide, anodic, 18: 25929
performance as coating on fast reactor fuel elements, 18: 26824(R) (ANL-6885)
VANADIUM ALLOYS
book: *Vanadium, Niobium, Tantalum. The Metallurgy of the Pure Metals and Their Alloys*, in German, 18: 25906
Cr–V, thermodynamic properties at 1550°K, 18: 25970(R) (ANL-6868 (p.303-25))
Ga–V, critical currents of superconducting, 18: 26464
Mn–V, crystal structure and phase studies, 18: 25970(R) (ANL-6868 (p.303-25))
Mo–V, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Ti–V, compatibility with sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Nb–Ti–V, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Nb–V, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Pd–V, thermoelectric powers at 700°C, 18: 25970(R) (ANL-6868 (p.303-25))
Ta–Ti–V, compatibility with sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Ta–V, phase studies, 18: 26055
Ti–V, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Ti–V, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Ti–V, performance as coating on fast reactor fuel elements, 18: 26824(R) (ANL-6885)
Ti–V, tensile properties at 20 to 800°C, 18: 25966(R) (ANL-6868 (p.120-32))
Ti–V–Zr, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
VANADIUM CARBIDES
crystal structure, 18: 25970(R) (ANL-6868(p.303-25))
VANADIUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
VANADIUM IONS
spectra in rutile, ESR, 18: 25411
VANADIUM ISOTOPES V-48
content in Sputnik 4 fragment, 18: 26127
production by proton reactions in thick iron targets, cross sections for, 18: 26583
VANADIUM OXIDES
CaO–CoO–V_2O_5–ZnO, analysis by x-ray fluorescence, 18: 25275
VANADIUM STEEL
Cr–Mo–V, creep of, enthalpy and entropy of activation of, 18: 25974 (EURAEC-1037)
VAPORIZATION
analysis of solid fuel, radiometric, 18: 25874
VEHICLES
radiation survey by detectors in M60 tank, correction factors for, 18: 25709 (NDL-TR-49)

VENEZUELA
fallout monitoring in, 1960 through 1962, 18: 25689
VESSELS
development of fire-resistant, 18: 26995(P)
VIBRATION TESTING
method for measuring elastic constants of small plates, 18: 25679
VINYL ALCOHOL POLYMERS
heat treatment effects on, effects of boric acid on, 18: 25487(T) (AEC-tr-6372(p.175-84))
radiation effects on, effects of boric acid on, 18: 25487(T) (AEC-tr-6372(p.175-84))
radiation effects on mechanical properties of acetylated, beta, 18: 25489(T) (AEC-tr-6372(p.193-5))
radiation effects on reactions with chlorine and sulfur dioxide, 18: 25490(T) (AEC-tr-6372(p.197-205))
radioinduced crosslinking in fibers and films of, properties of product in beta, 18: 25488(T) (AEC-tr-6372(p.185-92))
radioinduced graft polymerization with acrylonitrile, butadiene, and styrene, effects of heat treatment on, 18: 25482(T) (AEC-tr-6372 (p.135-40))
radioinduced graft polymerization on styrene, heat treatment effects on x-ray scattering in, 18: 25483(T) (AEC-tr-6372(p.141-3))
radioinduced graft polymerization on acrylamide, 18: 25485(T) (AEC-tr-6372(p.159-61))
VIRUSES
radiation effects on infection of mouse spleen by, 18: 25223
radiosensitivity of infectious nucleic acid portion and whole tobacco mosaic, to fast electrons, 18: 25159
VISCOSITY
calculation of hard-sphere, 18: 25362

W

WARFARE
military medical services for thermonuclear, 18: 25729
radiation survey by detectors in M60 tank in, correction factors for, 18: 25709 (NDL-TR-49)
WASTE DISPOSAL
low activity, discharge rate from Windscale Works to Irish Sea, 18: 25723
methods of, possibility of total containment in, 18: 26979
sound, computer program for calculating steady Darcian transport of fluids from, 18: 26975 (HW-72335(Pt.2))
tank storage methods of, thermal effects of leaks, 18: 26976 (HW-80848)
WASTE PROCESSING
calcination methods of, safety analysis of ICPP facility for, 18: 26977 (IDO-14620)
calcination methods of, development and evaluation of pot, 18: 26978 (ORNL-TM-857)
concentration and purification methods of, design of plant for, 18: 26992
fixation in glassy solids, development and evaluation of methods for, 18: 26978 (ORNL-TM-857)
fixation of radioactive muds on bitumen, 18: 26980(P)
ion exchange decontamination of high-level Savannah River waste supernate, 18: 26974 (BNL-853)
methods of, possibility of total containment in, 18: 26979
WASTE SOLUTIONS
flocculation of ammoniacal filtrates from uranium dioxide–plutonium oxide preparation, 18: 25895(R) (NUMEC-2389-3)
separation of rare earths and strontium from Purex, by ion exchange, 18: 25606 (ORNL-3585)
WATER
activation of, by X-agent, 18: 26146
additive effects on radiolysis of butyl chloride, 18: 25598
analysis for isotopic impurities, infrared analyzer for, 18: 25312(P)
analysis for strontium-90 by using carrier technique, triple precipitation, and counting, 18: 25267 (K-1521)
boiling, mechanism of saturated nucleate pool, 18: 25671
determination in argon and helium, instruments for, 18: 25264 (CNLM-4016)
determination in soils using radioisotopes, 18: 25699(T) (OTS-63-11008 (p.15-21))
effects of content of, on radiosensitivity of oat seeds, 18: 25181
effects on electric conductivity of molten lithium chlorides, 18: 26019
effects on ion exchange of uranium and other elements in system with organic acids, 18: 25305
electron binding in solutions of, model for, 18: 25577
gamma buildup factors for, 0.5- to 10-Mev, 18: 26814(T) (ORNL-tr-80)
hydrogen bond elongation in, isotopic substitution effects on, 18: 25417(T)
neutron diffusion length and pulse parameters for, 18: 26516
neutron diffusion parameters of, measurement using pulsed-source method, 18: 26828
neutron thermalization in, parameters for, 18: 26871
positronium decay in, magnetic quenching of, 18: 26221
radioisotope concentrations in, maximum permissible, 18: 25733
radiolysis of, formation and detection of intermediates in, 18: 25576
radiolysis of, kinetics of pulsed electron beam, 18: 25578
structure of, spectral study of, 18: 25368
structure of, spectral study of, 18: 25369
transfer of chloride ions to heavy water from, calculation of free energy of, 18: 25338
vapor pressure of, measurement of, 18: 25436
air-water, theory of two-phase annular flows of, 18: 25657(R) (NYO-3114-1)
$Gd(NO_3)_3$–HNO_3–H_2O–$Y(NO_3)_3$, phase studies, 18: 25434
HNO_3–2-propanol–H_2O, ion exchange of rare earths from, 18: 25395
HNO_3–2-propanol–H_2O, lead complexing in, 18: 25384
$La(NO_3)_3$–HNO_3–H_2O–$Y(NO_3)_3$, phase studies, 18: 25434
$Nd(NO_3)_3$–TBP–H_2O, complex formation in, 18: 25393
steam–water, flow pressure drop across thick plate restrictions in, 18: 25665
steam-water, two-phase expansion through convergent-divergent nozzle, 18: 25662
WATER-*d*
structure of, spectral study of, 18: 25369
WATER-d_2
analysis for isotopic impurities, infrared analyzer for, 18: 25312(P)
deuterium-oxygen bonds in, length of, 18: 25417(T)
structure of, spectral study of, 18: 25369
transfer of chloride ions to, from water, calculation of free energy of, 18: 25338
vapor pressure of, measurement of, 18: 25436
WATER-*t*
analysis for tritium, correction for, 18: 25309
effects on HeLa cells, 18: 25156
vapor pressure of, measurement of, 18: 25436
WATER-t_2
vapor pressure of, measurement of, 18: 25436
WATER COOLED REACTORS
experimental facilities for tank-type, hydraulic sample changer for, 18: 26973(P)
WATER MODERATED REACTORS
neutron thermalization in, parameters for, 18: 26871
reactivity Doppler feedback in oxide fueled, analysis of, 18: 26868
WATER PURIFICATION EQUIPMENT
design and performance of mobile, 18: 25726(T)
WATER VAPOR
corrosive effects on uranium at 100°C in absence of oxygen, effects of pressure on, 18: 25921 (AWRE-O-25/64)
WELDING
development for metal working, 18: 25955
electron-beam, vacuum chamber for large workpieces, 18: 25964(P)
equipment for inert-gas welding of end cap to sheathed fuel elements, 18: 25959(P)
equipment for sealing tubes to tube sheets, 18: 25961(P)
WELDS
cracking of, in steel, review of theories, effects, causes, and control of, 18: 25941 (DMIC-197)
WELL LOGGING
method for simultaneous tracer and natural gamma logging, 18: 25703(P)
neutron diffusion in, 18: 26506
WHEAT
cerium-144 content in, from U. S., 1962, 18: 25265 (HASL-143)
WHITE OAK CREEK

radioinduced chromosome aberrations in *Chironomus tentans* larvae from, as result of waste contamination, 18: 25212
WINDSCALE ADVANCED GAS COOLED REACTOR
fuel cans for, development of, 18: 26946
WINDSCALE PRODUCTION REACTORS
waste discharge from, to Irish Sea, 18: 25723
WIRES
fabrication of fine, high-strength beryllium, 18: 25938(R) (AD-439498)
tensile properties of as-drawn chemical-milled beryllium ultrafine, 18: 25975 (NAEC-AML-1909)
WORMS
radiation effects on *Fasciola hepatica*, 18: 25128
WOUNDS
radiation sickness effects on deferred treatment of firearm, in rabbits, 18: 25202

X

X AGENT
activation of water by, 18: 26146
effects on erythrocytes, 18: 26144
interference of thermal radiation by, 18: 26144
mirror-imaging effects of, 18: 26145
X RADIATION
biological effects of massive localized doses of, in treatment of lung carcinoma, 18: 25252
biological effects of, effect of dose fractionation on, 18: 25192
biological effects in mammalian cells, calculation of survival curves based on multi-target or multi-hit model, 18: 25171
cataractogenic effects of, effect of dose fractionation on, 18: 25200
chemical effects on normal and secondary butyl chlorides, 18: 25598
chemical effects on hexane, 18: 25555
detection and measurement of, design of proportional counter for, 18: 25834
detection and measurement of scattered, 18: 25838
detection and measurement of 1- to 10-kev, plastic scintillator for, 18: 25845
detection and measurement of, design of photovoltaic cell exposure rate meter for, 18: 25867
detection of biological effects of, method for immediate, 18: 25134
dose delivered to mediastinum during preoperative irradiation of lung tumors, comparison at 9 centers, 18: 25253
dose response of mammalian and bacterial cells in culture to, parameters for multi-target and multi-hit survival curves in, 18: 25170
dose-time relations for, for therapy of laryngeal carcinomas, 18: 25250
dosimetry of low-level, fluorescence apparatus for, 18: 25855(P)
effect on anthocyanin production in detached flower petals of *Impatiens balsamina*, 18: 25064
effectiveness of, in treatment of acne vulgaris, 18: 25235
effects of repeated sublethal doses of, on radioresistance and radio-excitability in rats, 18: 25127
effects of single dose at 7500 r on the oxygen consumption of chicken embryo intestine, 18: 25124
effects of small doses on leukocyte chromosomes in man, 18: 25163
effects on adrenal activity in man, 18: 25104
effects on alkali-halide crystals containing divalent impurities, 18: 25585(T)
effects on all biochemistry and morphology in rabbit tissue cultures, 18: 25117
effects on amino acid metabolism in rabbits, 18: 25198
effects on atherosclerosis development in pigeons, 18: 25087(R) (TID-20641)
effects on bacterial agglutination by rabbit liver polypeptides, 18: 25110
effects on behavior of aging dogs, 18: 25091(R) (UCD-472-109(p.49-52))
effects on blood picture in starch-injected and normal parabiotic rabbits, 18: 25150
effects on blood serum protein content in rats, 18: 25140
effects on desoxyribonucleic acid content and morphology of lymph nodes in guinea pigs, whole-body, 18: 25102
effects on desoxyribonucleic acid synthesis in bone marrow and tumor cells in rats and mice, 18: 25166
effects on desoxyribonucleic acid synthesis in bone marrow and tumor cells in rats and mice, 18: 25173
effects on desoxyribonucleic acids of rat spleen, whole-body, 18: 25084 (NYO-2568-1)
effects on desoxyribonucleic acid synthesis in mouse spleen *in vivo*, 18: 25186
effects on development of transplanted tumors in rats, 18: 25197
effects on donor bone marrow cells exposed *in vivo*, 18: 25201
effects on *E. coli*, effects of oxygen on reparation of, 18: 25229
effects on ears of Amblystoma embryos, protective effects of parabiosis against, 18: 25148
effects on enzyme activity in stomach of rats, 18: 25086(R) (TID-20636)
effects on eyes of dogs, 18: 25090(R) (UCD-472-109(p.45-8))
effects on fertility of guinea pigs, 18: 25230
effects on fertility of male guinea pig, 18: 25191
effects on gastric passage time in rats, 18: 25172
effects on gill formation and regeneration in *Branchiura sowerbyi*, 18: 25135
effects on homologous skin grafts in rats, 18: 25114
effects on life span of dogs, statistical analysis of, 18: 25094(R) (UCD-472-109(p.173-7))
effects on liver after uterine carcinoma therapy, effects of halothane on, 18: 25119
effects on lymphocyte segment index in guinea pigs, 18: 25203
effects on mice, effects of bleeding on, 18: 25116
effects on mice, protective effects of ethyl palmitate against, 18: 25216
effects on mitosis in rats, 18: 25101
effects on mouse immunological tolerance, 18: 25157
effects on nervous system of rabbits exposed *in utero*, 18: 25121
effects on nucleic acid metabolism during embryonic development in barley seed, 18: 25175
effects on peroxidase activity in Mycobacteria, 18: 25111
effects on pyridoxal phosphate in *E. coli*, 18: 25103
effects on rabbit serum iron, 18: 25164
effects on rabbits, protective effects of polysaccharides against, 18: 25218
effects on rat polysaccharide phosphorylase activity, x, 18: 25115
effects on rat stress accommodation, 18: 25100
effects on reproductive capacity of female dogs, 18: 25092(R) (UCD-472-109(p.53-61))
effects on respiratory activity in normal and tumor tissues, 18: 25168
effects on response of spleen to virus infection, in mice, 18: 25223
effects on response of guinea pigs to Brucella vaccine, 18: 25096(T) (JPRS-24896)
effects on spleen proliferation by transplanted marrow cells in mice, 18: 25189
effects on structure of pentaerythritol, 18: 26083
effects on survival of rats, protective effects of abdomen, chest, and head screening against, 18: 25225
effects on testicles of bulls, 18: 25185
effects on tumor growth and development of metastases in mice, 18: 25162
effects on viability of skin grafts, 18: 25113
effects on water circulation in gastrointestinal tract in rats, 18: 25155
emission in electron reactions with copper at 20 to 50 kev, intensity of $K\alpha$, 18: 26205
emission in tin-119 internal conversion, coefficients for, 18: 26642
genetic effects in male Drosophila, 18: 25108
genetic effects in peanuts, 18: 25132
genetic effects in plants, 18: 25133
genetic effects in onion seeds, 18: 25179
genetic effects in oats, 18: 25184
genetic effects of, in castorbean seeds, 18: 25180
genetic effects of, in barley seeds, 18: 25182
genetic effects on xanthine dehydrogenase in Drosophila, 18: 25208
genetic effects on male rats, 18: 25215(T) (AEC-tr-6227/1(p.25-44))
induction of rabbit cataracts by, 18: 25195
lethal dosage determinations of, for mice, 18: 25165
lethal effects on metacercaries of *Fasciola hepatica*, 18: 25128
leukemogenic effects during pregnancy, 18: 25152
measurement of, at eye position of fluoroscopic screen assemblies, 18: 25249

oxidation of fatty acids induced by, 18: 25570
pathological effects of, in dogs, 18: 25093(R) (UCD-472-109(p.62-172))
pathological effects on skin, 18: 25214 (AHSB(RP)R-39(p.87-93))
reactions with beryllium, oxidation effects on ionization absorption cross sections for, 18: 26215(T)
scattering in heat treated graft polymerized PVA, 18: 25483(T) (AEC-tr-6372(p.141-3))
scattering of 60- to 80-kev, dose measurements in water phantom, 18: 25255
spectra from electron-bombarded silver-foil, 18: 26224
therapy of cervical carcinomas using, complications after, 18: 25167
time-dose relations for, for treatment of Hodgkin's disease, 18: 25251

X-RAY BEAMS
dosimetry of, contribution of scattered radiation to, 18: 25838

X-RAY-DIFFRACTION ANALYSIS
computer program for lattice type and cell constants from x-ray powder diffraction data, 18: 26108 (IS-839)
equipment and techniques for, 18: 25971(R) (ANL-6868(p.331-7))
intensity corrections for weakly absorbing polycrystals, 18: 26104 (BM-RI-6455)
thermal expansion measurements from lattice parameters of Debye-Scherrer specimens, 18: 26109 (LA-2687)

X-RAY EQUIPMENT
betatron for nondestructive, materials testing, portable, 18: 25677
control of physical standards for, 18: 25248
design of fluoroscope using gamma source instead of x-ray tube, 18: 25234 (SGAE-IB/IA-2/1964)
design of port structure for rectanglar beams, 18: 26994(P)
design of portable fluorescent, using radioisotope sources, 18: 25275
design of, to reduce radiation dose to patients and physicians during radiography, 18: 25241
radiation protection of operators of fluoroscopic equipment, 18: 25249

X-RAY SOURCES
observations and theory of celestial, 18: 26200

X-RAY SPECTROMETERS
design, 18: 25852
design of analyzer using beta radiation, 18: 25768(P)

X-RAY SPECTROSCOPY
use for plasma thermometry, 18: 26708(T) (AEC-tr-5589(p.861-8))

XANTHATES
potassium ethyl-, preparation of sulfur-35-labeled, 18: 25460

XENON
additive effects on lifetime of metastable helium atoms, 18: 26238
alpha-particle trajectory in, distribution of photons and ions along, 18: 26121
bubble release and swelling in solids, model for, 18: 26080
charge transfer with protons, cross sections for Lyman alpha emission from, 18: 26235
chemistry of, in aqueous solution, 18: 25358
diffusion from coated and uncoated ceramic fuel particles, 18: 25983 (SGAE-ME-1/1964)
diffusion in irradiated uranium fuel elements, 18: 26903
electron emission by solid, secondary, 18: 26156
melting temperature of, equations for calculating, 18: 25990
properties in aqueous solutions, 18: 25357

XENON FLUORIDES
bonding in, theories on, 18: 25372
hydrolysis of aqueous solutions of, preparation of sodium perxenates by, 18: 25357
hydrolysis of divalent, in aqueous solution, 18: 25358
preparation and structure of, review on, 18: 25401

XENON IONS
electron-capture cross sections at 0.4 to 3.6 kev, 18: 26229

XYLENE
radiation effects on, ESR spectra of, 18: 25520(T) (AEC-tr-6372(p.481-90))

XYLENOL ORANGE
analytical use for spectrophotometric determination of rare earths, 18: 25285

XYLOSE
oxidation by sodium chlorite tritium kinetic isotope effects in, 18: 25459

Y

YEASTS
radiation injuries of, protective effects of *p*-chloromercuribenzoate against, 18: 25224

YTTERBIUM
determination using Xylenol Orange, spectrophotometric, 18: 25285
diffusion of nitrogen and oxygen in, internal friction in interstitial, 18: 26050
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
helium-3 elastic scattering at 20 Mev, differential cross sections, 18: 26681
magnetic moment of ions of, in crystalline state and in solution, 18: 25350
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
separation from scandium by cation exchange chromatography, 18: 25613
solvent distribution in perchloric acid–TBP systems, 18: 25381
sorption by ion exchange resins from nitric acid–2-propanol–water solutions, 18: 25395
spectra in thorium oxide at 100°K, nephelauxetic effects on reflection, 18: 25423

YTTERBIUM ACETYLACETONATES
complexity constants of, determination of step-wise, 18: 25385

YTTERBIUM AZIDES
thermal decomposition of, differential thermal analysis of, 18: 25446

YTTERBIUM CHLORIDES
entropy of formation and vapor pressure over, 18: 25426
$KCl–YbCl_3$, vapor pressure, 18: 25435

YTTERBIUM ISOTOPES Yb-154
alpha decay of, energies and rates for, 18: 26640

YTTERBIUM ISOTOPES Yb-171
transition spectra in, Alaga's rules for electromagnetic, 18: 26628

YTTERBIUM ISOTOPES Yb-173
transition spectra in, Alaga's rules for electromagnetic, 18: 26628

YTTERBIUM ISOTOPES Yb-174
carbon-12 fission at 109 and 125 Mev, energy-mass distributions in, 18: 26558 (UCRL-11377)

YTTERBIUM NIOBATES
$CaMoO_4–YbNbO_4$, preparation and spectra of, 18: 26017
$CaWO_4–YbNbO_4$, preparation, luminescent properties, and structure of, 18: 26017

YTTERBIUM PHOSPHATES
preparation and single crystal growth of ortho-, 18: 25356

YTTERBIUM SYSTEMS
B–C–Yb, phase studies, 18: 25319 (COO-1140-103)

YTTRIUM
alloying effects on corrosion properties of types 405 and 406 stainless steel, 18: 26894(R) (ANL-6868(p.109-16))
elastic properties at 4 to 900°K, 18: 25968(R) (ANL-6868(p.267-86))
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
oxidation in air at 900 and 1400°C, 18: 25930
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
separation from scandium by cation exchange chromatography, 18: 25613
sorption by ammonium phosphomolybdates, mechanism of, 18: 25378

YTTRIUM ACETYLACETONATES
stability of, effects of ionic size on, 18: 25389

YTTRIUM ALLOYS
Dy–Y, magnetic properties of, 18: 25981(R) (ORNL-3582(p.11-16))
Er–Y, magnetic properties of, 18: 25981(R) (ORNL-3582(p.11-16))
Ho–Y, magnetic properties of, 18: 25981(R) (ORNL-3582(p.11-16))
Tb–Y, magnetic properties of, 18: 25981(R) (ORNL-3582(p.11-16))
Tm–Y, magnetic properties of, 18: 25981(R) (ORNL-3582(p.11-16))

YTTRIUM AZIDES
thermal decomposition of, differential thermal analysis of, 18: 25446

YTTRIUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

YTTRIUM COMPLEXES

with acetyl-, benzoyl-, and propionylacetonates, stability of, 18: 25389
YTTRIUM FERRATES
gallium-69 and -71 NMR in substituted, 18: 25413
YTTRIUM FLUORIDES
spectrum of mono-, electronic band, 18: 26163
YTTRIUM HYDRIDES
thermodynamics of nonsubstitutional solid solutions of, statistical model for, 18: 25421
YTTRIUM NIOBATES
fluorescence spectra, 18: 26017
$CaWO_4$–$YNbO_4$, preparation, luminescent properties, and structure of, 18: 26017
YTTRIUM NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
$Gd(NO_3)_3$–HNO_3–H_2O–$Y(NO_3)_3$, phase studies, 18: 25434
$La(NO_3)_3$–HNO_3–H_2O–$Y(NO_3)_3$, phase studies, 18: 25434
YTTRIUM OXIDES
energy transfer effects in europium doped, nonradiative resonant, 18: 25564
thermal expansion to above 2000°C, 18: 25355
MgO–Y_2O_3, thermal expansion to above 2000°C, 18: 25355
YO_3–ZrO_2, analysis for zirconium by precipitation using cupferron, 18: 25277
YTTRIUM PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
YTTRIUM SULFATES
reduction of anhydrous, by carbon monoxide, 18: 25427
YTTRIUM SYSTEMS
H–Y, statistical model for thermodynamics of nonsubstitutional solid solutions of, 18: 25421
YTTRIUM TANTALATES
fluorescence spectra, 18: 26017

Z

ZINC
corrosion by oxygen, and by sodium chloride, nitrate, and sulfate solutions, tracer studies on, 18: 25927
determination in hydrochloric and nitric acids, activation, 18: 25286
diffusion in pure and zinc-doped sodium chloride monocrystals, 18: 25969(R) (ANL-6868(p.287-302))
melting temperature of, equations for calculating, 18: 25990
neutron elastic scattering at 0.5 to 0.8 Mev, cross sections for, 18: 26568
protective effects against nucleic acid decomposition by nuclease, 18: 25085 (SGAE-BL-5/1964)
radiation effects on deformation of single crystals of, 18: 26090
separation from uranium by ion exchange and elution with ascorbic acid, 18: 25611(T) (AEC-tr-6227/1(p.1-8))
solvent partition in aqueous bromide–TBP systems, 18: 25382
sorption on anion exchange papers in hydrobromic and hydrochloric acids and lithium chloride, 18: 25374
ZINC ALLOYS
Al–Cu–Mg–Zn, corrosion resistance of, effects of age hardening, chromium, and silver on stress, 18: 25946(T) (RSIC-177)
Al–Zn, radiation effects on zone formation in crystalline, 18: 26069(R) (ANL-6868(p.373-417))
ZINC CHLORIDES
separation by reversed phase partition chromatography using organophosphorus compounds, 18: 25614
ZINC COMPLEXES
with dialkyl phosphoric acids, preparation and properties, 18: 25429
with substituted 2-(pyridyl) and 2-(quinolyl)-1,3-indanediones, acid dissociation and formation constants of, 18: 25457
ZINC CYANIDES
distribution coefficients in lithium chloride ion exchange systems, 18: 25297
ZINC ISOTOPES Zn-64
proton scattering at 5.8 Mev by, gamma-proton angular correlations in inelastic, 18: 26582
ZINC ISOTOPES Zn-65
diffusion in pure and zinc-doped sodium chloride monocrystals, 18: 25969(R) (ANL-6868(p.287-302))
uptake by biological organisms in fresh-water pond, 18: 25079
ZINC ISOTOPES Zn-66
proton scattering at 5.8 Mev by, gamma-proton angular correlations in inelastic, 18: 26582
ZINC ISOTOPES Zn-68
proton scattering at 5.8 Mev by, gamma-proton angular correlations in inelastic, 18: 26582
ZINC NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
ZINC OXIDES
CaO–CoO–V_2O_3–ZnO, analysis by x-ray fluorescence, 18: 25275
ZINC PERCHLORATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614
ZIRCALOY-2
compatibility with aluminum–plutonium alloy at 600°C, 18: 26893(R) (ANL-6868(p.11-108))
corrosion by sodium, temperature dependence of, 18: 25937
dimensional changes during annealing in, temperature gradient effects on, 18: 26028
fabrication of tubular, 18: 25939(R) (ANL-6868(p.201-18))
mechanical properties, 18: 25894(R) (NMI-2128)
radiation effects on tensile properties of, neutron, 18: 26096
Be–Zircaloy-2, hardness, 18: 25894(R) (NMI-2128)
ZIRCONIUM
alloying effects on niobium oxidation, 18: 25936
alloying effects on electric conductivity, hardness, and structure of niobium, 18: 25999
alloying effects on oxidation of plutonium–uranium alloys, 18: 26893(R) (ANL-6868(p.11-108))
bonding to ferrous metals, 18: 25962(P)
corrosion by steam, effects of additives on, 18: 26824(R) (ANL-6885)
creep at high temperature, 18: 26002
crystal structure and phase studies, 18: 25968(R) (ANL-6868(p.267-86))
determination in molybdenum alloys, plasma arc technique for spectrochemical, 18: 25268 (ML-TDR-64-36)
determination in tungsten, spectrophotometric, 18: 25281
determination in yttrium oxide–zirconium oxide mixtures by precipitation using cupferron, 18: 25277
elastic properties of monocrystalline, to 1200°K, 18: 25967(R) (ANL-6868(p.231-3))
elastic properties at 4 to 1200°K, 18: 25968(R) (ANL-6868(p.267-86))
electric and mechanical properties of oxidized, 18: 25920(R) (ANL-6868(p.338-54))
electrolytic deposition with nickel, niobium, tantalum, and titanium, 18: 26057
emission spectra of, use of fuel-rich, premixed oxyacetylene flame for, 18: 25278
mechanical properties, 18: 25894(R) (NMI-2128)
neutron elastic scattering at 0.5 to 0.8 Mev, cross sections for, 18: 26568
neutron elastic scattering at 5.0 Mev, angular distribution, 18: 26668
neutron inelastic scattering at 4.0 to 6.5 Mev, energy spectra, 18: 26668
oxidation by oxygen at 700°C, 18: 25920(R) (ANL-6868(p.338-54))
plastic deformation of hydrided, 18: 25968(R) (ANL-6868(p.267-86))
production and uses, 18: 25898
production by fusion electrolysis, 18: 25913(P)
production in U. S., 18: 25908
reactions with hydrogen peroxide in alkaline solutions, properties of product in, 18: 25379
reactions with rare earth borides, 18: 25319 (COO-1140-103)
separation from niobium and neptunium by ion exchange, 18: 25294
separation from uranium and other elements using bromomandelic acid, 18: 25283
spectra of oxide films on, effects of refractive index on infrared, 18: 25925
ZIRCONIUM ALLOYS
corrosion by steam at 540 and 650°C, 18: 25919(R) (ANL-6868(p.190-

200))
pickling of, equations for extrapolation to technological scale, 18: 25902
Al–Mo–Sn–Zr, corrosion by sodium, 18: 25937
Al–Zr, analysis for uranium, fluorometric, 18: 25283
Be–Zr, mechanical properties of splatcooled, 18: 25894(R) (NMI-2128)
Co–Ta–Zr, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Cu–Fe–Zr, corrosion by steam, effects of additives on, 18: 26824(R) (ANL-6885)
Fe–Zr, anisotropic hfs interactions of, 18: 26038
Hf–Os–Zr, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Hf–Re–Zr, phase studies, 18: 25970(R) (ANL-6868(p.303-25))
Hf–Zr, crystal structure and phase studies, 18: 25968(R) (ANL-6868 (p.267-86))
Hf–Zr, elastic properties at 4 to 600°K, 18: 25968(R) (ANL-6868 (p.267-86))
Mg–Zr, grain-boundary cracking and mode of creep failure in, 18: 26032
Mo–Nb–W–Zr, homogenization kinetics of sintered, 18: 26047
Mo–Nb–W–Zr, homogenization kinetics of sintered, 18: 26052
Mo–Nb–Zr, phase studies and properties, 18: 26056
Mo–Ti–Zr, performance as coating on fast reactor fuel elements, 18: 26824(R) (ANL-6885)
Mo–Ti–Zr, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Mo–Zr, internal friction in deformed crystals of, 18: 26041(T)
Nb–Ti–Zr, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Ti–Zr, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Nb–W–Zr, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868 (p.11-108))
Nb–Zr, coating development for oxidation protection, 18: 25896(R) (PF-63-3)
Nb–Zr, compatibility with fissium–plutonium–uranium alloys at 550 to 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Zr, corrosion by sodium at 650°C, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Zr, dimensional changes during annealing in, temperature gradient effects on, 18: 26028
Nb–Zr, energy gap of high-field superconducting, 18: 26481
Nb–Zr, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Nb–Zr, flux jumping and training in superconducting solenoids of, 18: 26470
Nb–Zr, phase studies, 18: 26003
Nb–Zr, properties for superconducting solenoids, 18: 26474
Nb–Zr, radiation effects on tensile properties of, 18: 26096
Nb–Zr, tensile properties at 20 to 950°C, 18: 25966(R) (ANL-6868 (p.120-32))
Ta–W–Zr, phase diagrams, 18: 25985 (WADD-TR-60-132(Pt.III))
Ti–V–Zr, fabrication and properties, 18: 26893(R) (ANL-6868(p.11-108))
Ti–Zr, creep of beta, 18: 26011
U–Zr, bonding to ferrous metals, 18: 25962(P)
U–Zr, separation of uranium from, using bromomandelic acid, 18: 25283

ZIRCONIUM CARBIDES
crystal structure, 18: 25970(R) (ANL-6868(p.303-25))
thermal conductivity and diffusion, 18: 25986 (WADD-TR-60-581(Pt.IV))
UC–ZrC, performance as in-pile thermionic electrodes, 18: 26259
UC–ZrC, properties as thermionic emitters for cesium-vapor cells, 18: 26253(R) (GA-4677)

ZIRCONIUM CHLORIDES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

ZIRCONIUM COMPLEXES
with Alizarin S, separation by solvent extraction using butanol, 18: 25306
with β-hydronaphthazarin and naphthazarin, formation constants and spectra of, 18: 25456

ZIRCONIUM HYDRIDES
neutron thermalization in, measurement of, 18: 26514

ZIRCONIUM ISOTOPES Zr-90
neutron capture by, s-wave strength functions for, 18: 26544(R) (ORNL-3582(p.82-4))

ZIRCONIUM ISOTOPES Zr-92
neutron capture by, s-wave strength functions for, 18: 26544(R) (ORNL-3582(p.82-4))
nucleon interactions in, potentials for, 18: 26638

ZIRCONIUM ISOTOPES Zr-94
neutron capture by, s-wave strength functions for, 18: 26544(R) (ORNL-3582(p.82-4))

ZIRCONIUM ISOTOPES Zr-95
uptake by deer lungs, 18: 25693

ZIRCONIUM ISOTOPES Zr-96
neutron capture by, s-wave strength functions for, 18: 26544(R) (ORNL-3582(p.82-4))

ZIRCONIUM NITRATES
separation by reversed-phase partition chromatography using organophosphorus compounds, 18: 25614

ZIRCONIUM OXIDES
spectra of films of, on zirconium, effects of refractive index on infrared, 18: 25925
with dialkyl phosphoric acids, preparation and properties, 18: 25429
PuO_2–ZrO_2, preparation and properties of spherical particles of, 18: 26008
UO_2–ZrO_2, thermal conductivity at high fission depletion, effective in-pile, 18: 26073 (WAPD-246)
YO_2–ZrO_2, analysis for zirconium by precipitation using cupferron, 18: 25277

ZIRCONIUM SYSTEMS
C–U–Zr, phase studies, 18: 25269(R) (NLCO-905)
O–Ta–Ti–Zr, phase studies, 18: 26053
S–Zr, stability and thermodynamics of, 18: 26065

REPORT NUMBER INDEX

Reports, numbered translations, and patents abstracted during the period are included in this index. Each item is listed by report number; this is followed by the abstract number and a brief notation regarding public availability. The index entries show, when known, which reports are on file in the depository libraries, which reports have been published in open-literature journals (journal citation given), and which reports can be purchased (source and price). Whenever a report is identified by more than one number, cross references from secondary to primary report numbers are cited.

The report number codes apply to AEC reports unless designated otherwise. Non-AEC reports are identified by parenthetical notes after the report codes; e.g., (non-AEC), (British), (Canadian), (French). The note (Misc.) identifies those codes used for both USAEC and non-AEC reports. Patents are listed under the heading "PATENTS"; the country of origin is included in parentheses.

A comprehensive listing of both AEC and non-AEC report codes is contained in TID-85(3rd Rev.), *Report Number Series Used by the Division of Technical Information in Cataloging Reports*, to be published.

Public Availability of USAEC Reports

All USAEC reports abstracted in *NSA* are available to the public through one or more of the following sources:

(1) Depository libraries in the United States, in other countries, and in international agencies. A list of these depositories, many of which have facilities for preparing photocopy for sale, appears on the inside covers of each issue of *NSA*.

(2) Scientific and technical journals or other publications.

(3) Microcard Editions, Inc., in Microcard and micronegative form. Orders and inquiries should be sent to: Accounting and Shipping Department, West Salem, Wisconsin 54669.

(4) Clearinghouse for Federal Scientific and Technical Information, National Bureau of Standards, U. S. Department of Commerce, Springfield, Virginia, for sale as full-size printed copy, photostat or facsimile (Xerox), and microfilm.

(5) Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, for sale as full-size printed copy.

Public Availability of Non-AEC Reports

U. S. Reports. Many reports of U. S. Government agencies other than the AEC can be obtained by the public in the same manner as AEC reports. The availability of these reports is given when known. If availability is not shown, inquiries should be directed to the Clearinghouse for Federal Scientific and Technical Information. Inquiries concerning "NP" reports should be by title and author rather than by report number.

Non-U. S. Reports. Many reports of atomic energy establishments of other countries are deposited in the libraries listed on the inside covers of each issue of *NSA*.

Additionally, the following countries have made their reports available as indicated.

AUSTRALIA

Australian Atomic Energy Commission Research Establishment. Available upon request from the Library, Australian Atomic Research Establishment, Private Mail Bag, Sutherland, New South Wales, Australia.

BELGIUM

Centre d'Étude de l'Énergie Nucléaire. Available upon request to individuals and organizations, from the Centre d'Étude de l'Énergie Nucléaire (CEN), 31, Rue Belliard, Bruxelles, Belgium.

CANADA

Atomic Energy of Canada Limited. For sale by the Technical Information Officer, Atomic Energy of Canada Limited, Chalk River, Ontario, Canada. Copies are also deposited in libraries in the United Kingdom.

National Research Council of Canada. Available from the National Research Council of Canada, Ottawa 2, Ontario, Canada.

DENMARK

Atomic Energy Commission Research Establishment, Risø. Available on exchange from the Library, Danish Atomic Energy Commission, Risø, Roskilde, Denmark. Also for sale by Jul. Gjellerup, Booksellers, 87 Sölvgade, Kobenhavn K., Denmark.

Danatom. Available on loan from Research Establishment, Risø, Roskilde, Denmark. Copies are available from Danatom, Aurehojvej 2, Hellerup, Denmark.

FRANCE

Commissariat à l'Énergie Atomique. Inquiries should be addressed to Commissariat à l'Énergie Atomique, Service Central de Documentation, Centre d'Études Nucléaires de Saclay, Boite Postale No. 2, Gif-sur-Yvette (S. et O.), France.

Service Central de Protection contre les Rayonnements Ionisants. Copies are available from Ministère de la Santé Publique, Service Central de Protection contre les Rayonnements Ionisants, B. P. n° 35–LE VESINET (S. et O.), France.

GERMANY

Deutsches Elektronen-Synchrotron DESY. Copies are available from Deutsches Elektronen-Synchrotron Desy, Dokumentation, 2000 Hamburg-Gr. Flottbek 1, Notkestieg 1, Germany.

Kernforschungsanlage. Copies may be ordered from Zentralbibliothek der Kernforschungsanlage Jülich, Jülich, Bundesrepublik Deutschland.

Hahn-Meitner-Institute für Kernforschung. Available without charge from Hahn-Meitner-Institute für Kernforschung Berlin, Bibliothek, Glienicker Strasse 100, 1 Berlin 39, Germany. Copies are deposited in many national nuclear centers in the world.

Johann-Wolfgang-Goethe Universität, Frankfurt Am Main, Institut für Kernphysik, (IKF). Copies are available from Gmelin Institut, 40-42 Varrentrappstrasse, Frankfurt (Main), West Germany.

ISRAEL

Israel Atomic Energy Commission. Available without charge from Ministry of Defence/Atomic Energy Commission, Soreg Research Establishment, Yavne, Israel. Copies are deposited in libraries in Israel and in other countries.

ITALY

Centro Informazioni Studi Esperienze (CISE). For sale at CISE Press Office, Casella Postale 3986, Milano, Italy. Copies are deposited in libraries in Italy.

Comitato Nazionale per l'Energia Nucleare. Copies are available from Comitato Nazionale per l'Energia Nucleare, Divisione Affari Internazionali e Studi Economici, Ufficio Pubblicazioni, Via Belisario, 15, Roma, Italy.

JAPAN

Japan Atomic Energy Research Institute (JAERI). Available from the Staff Supply Cooperative of Japan Atomic Energy Research Institute (JAERI), 1-1 Tamura-Cho, Shiba, Minato-Ku, Tokyo, Japan. Copies are deposited in depositories in Tokyo, Nagoya, and Osaka.

Nagoya University. Copies are available from Research Information Center, Institute of Plasma Physics, Nagoya University, Nagoya, Japan.

University of Tokyo. Available free of charge from Institute for Nuclear Study, University of Tokyo, Tanashi-Machi, Kitatama-gun, Tokyo, Japan.

NETHERLANDS

Reactor Centrum Nederland. For sale by Reactor Centrum Nederland, 112 Scheveningseweg, 's-Gravenhage, The Netherlands. Copies are deposited in university libraries in Holland and in many national nuclear centers in the world.

NEW ZEALAND

Institute of Nuclear Sciences. Copies are available from Librarian, Institute of Nuclear Sciences, D.S.I.R., Private Bag, Lower Hutt, New Zealand. Copies are deposited in other countries.

NORWAY

Forsvarets Forskningsinstitutt. Copies available from Norwegian Defence Research Establishment, Library, P. O. Box 25, Kjeller, Norway.

Institutt for Atomenergi. "KR" reports are available on an exchange basis from the Library, Institutt for Atomenergi, Box 40, Kjeller, Norway. Other series are not generally available to the public.

Norwegian Reactor School. Copies are available from The Library, Institutt for Atomenergi, P. O. Box 40, Kjeller, Norway.

PAKISTAN

Atomic Energy Center. Copies are available from Atomic Energy Center, P. O. Box 658, Lahore, (West Pakistan).

POLAND

Biuro Pełnomocnika Rządu do Spraw Wykorzystania Energii Jądrowej, (CLOR). Copies are available from Pełnomocnik Rządu d/s Wykorzystania Energii Jądrowej, Ośrodek Informacji Naukowej, Technicznej i Ekonomicznej, Warszawa, PK i N, Poland.

SPAIN

Junta de Energia Nuclear. "JEN" reports are available without charge from Servicio de Documentation, Junta de Energia Nuclear, Ciudad Universitaria, Madrid (3), Spain.

SWEDEN

Aktiebolaget Atomenergi. "AE" reports are for sale from Aktiebolaget Atomenergi, Library Section, Box 43041, Stockholm 43, Sweden. Bibliographies and literature surveys of the VDDIT- series may be obtained from Aktiebolaget Atomenergi, Information Office, Scientific and Technical Information, Box 43041, Stockholm 43, Sweden. Other series are not generally available to the public. Organizations in the atomic energy field may obtain copies from Aktiebolaget Atomenergi. Microcopy of AE reports is available from the International Documentation Centre, Tumba, Sweden.

SWITZERLAND

CERN European Organization for Nuclear Research. Available without charge from CERN European Organization for Nuclear Research, Geneva 23, Switzerland. Copies are deposited in libraries in 13 countries.

Eidgenössisches Institut für Reaktorforschung. "EIR" reports are available from Eidgenössiches Institut fur Reaktorforschung, c/o Bibliothek, Würenlingen/AG, Switzerland.

TURKEY

Turkish Atomic Energy Commission. Copies are available free of charge from T.A.E.C., Çekmece Nuclear Research Center, P.O. Box 1, Airport, Istanbul, Turkey.

UNITED KINGDOM

United Kingdom Atomic Energy Authority. Some reports are for sale in the United States by the British Information Service (BIS), 845 Third Avenue, New York, N. Y. 10022. United Kingdom reports generally may be purchased from Her Majesty's Stationery Office, London. Copies not for sale by Her Majesty's Stationery Office may be purchased in microcopy form from Micro Methods Limited, East Ardsley, Wakefield, Yorks, England. Report copies are deposited in a large number of libraries in England.

Abbreviations Used in Availability Column

AECL	For sale by Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada.
BIS	For sale by the British Information Service, 845 Third Avenue, New York, N. Y. 10022.
Dep.	AEC reports: Full-size copy is on deposit in the depository libraries both inside and outside the United States. These reports are also for sale by Microcard Editions, Inc., Accounting and Shipping Department, West Salem, Wisconsin 54669. Non-AEC reports: Full-size copy on deposit in the depository libraries in the United States only.
Dep.(mc)	Same as for Dep., except copy is in Microcard form.
DSIR	For sale by the National Lending Library for Science and Technology (D.S.I.R.), Boston Spa, Yorkshire, England.
DTI Extension	Available from the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37831.
EM	Blueprints and Microcopy of AEC engineering drawings are available from Clearinghouse for Federal Scientific and Technical Information, National Bureau of Standards, U. S. Department of Commerce, Springfield, Virginia. Current prices of the CAPE-packages may be obtained from this address. TID-4100, available from the Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37831, contains information on all the CAPE- packages for sale.
Gmelin	Available at a nominal charge and under the AED-number shown from Atomic Energy Documentation Center, Gmelin Institute, 40-42 Varrentrappstrasse, Frankfurt (Main), West Germany.
GPO	For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.
HMSO	Her Majesty's Stationery Office, London.
IAEA	Available from the International Atomic Energy Agency.
JCL	For sale by the Special Libraries Association Translation Center, John Crerar Library, 35 West 33rd Street, Chicago, Illinois 60616.
LC	For sale by the Library of Congress, Photoduplication Service, Washington, D. C. 20540.
NAS	National Academy of Sciences, National Research Council, Washington, D. C. 20418.
NRC	For sale by the National Research Council of Canada, Ottawa, Ontario, Canada.
ORINS	Available on interlibrary loan from the Library, Oak Ridge Institute of Nuclear Studies, Post Office Box 117, Oak Ridge, Tennessee 37831.
OTS	For sale by the Clearinghouse for Federal Scientific and Technical Information, National Bureau of Standards, U. S. Department of Commerce, Springfield, Virginia.
UKAEA, London	Available from United Kingdom Atomic Energy Authority, 11 Charles II Street, London, S. W. 1.
USGS	Available free of charge from the U. S. Geological Survey, Washington, D. C. 20242.

[The symbols "ph," "mf," and "fs" are used to designate that copy is available only in photostat, microfilm, or facsimile (Xerox) form.]

Report No.	Abstract No.	Availability
ACNP–	**(Misc.)**	
63031	18-26914	Dep.(mc); $2.60(fs), $1.10(fs) OTS
AD–	**(Misc.)**	
423086	18-26250	
423178	18-26107	See ERR-FW-210
426960	18-26253	See GA-4677
427734	18-26116	See WADD-TR-61-72(Vol.XIX)
437128	18-26689	See BSD-TDR-64-34
437129	18-26252	See BSD-TDR-64-35
437194	18-26459	$1.60(OTS)
437280	18-26251	$5.60(OTS)
437994	18-25712	See USNRDL-TR-722
438432	18-25941	See DMIC-197
439498	18-25938	$1.60(OTS)
AE–	**(Non-AEC)**	
142	18-25464	Dep.(mc)
AEC-tr–		
5589	18-26694	Dep.; $10.50(OTS)
6227/1	18-26989	Dep.; $0.50(OTS)
6372	18-25470	Dep.; $7.50(OTS)
AECL–	**(Canadian)**	
1786	18-25603	See CEI-18
1787	18-25604	See CRC-487
1916	18-26917	See DM-72
AEEW-M–	**(British)**	
369	18-26830	Dep.(mc)
381	18-25776	Dep.(mc)
395	18-25777	Dep.(mc)
AERE-R–	**(British)**	
4208	18-26026	J. Nucl. Mater., 11: 149-62(1964)
4353	18-26027	J. Nucl. Mater., 11: 163-82(1964)
4429	18-26080	J. Nucl. Mater., 11: 135-48(1964)
4581	18-25465	Dep.; $0.60(BIS); 3s. (HMSO)
4583	18-25602	Dep.; $0.70(BIS); 3s. 6d. (HMSO)
4587	18-25466	Dep.; $1.00(BIS); 5s. (HMSO)
AHSB(RP)-R–	**(British)**	
39	18-25037	Dep.; $3.40(BIS); 17s. 0d. (HMSO)
AI–	**(Misc.)**	
8971	18-26067	$2.60(fs), $0.95(mf) OTS
64-75	18-25314	
ANL–		
6728	18-25674	Dep.; $0.50(OTS)
6799	18-26068	Dep.; $0.50(OTS)
6868	18-25891	Dep.; $5.50(OTS)
6885	18-26824	Dep.; $2.00(OTS)
ARL–	**(Non-AEC)**	
64-44(Pt.II)	18-26686	
64-49	18-26687	OTS
64-60	18-26688	OTS
AROD–	**(Misc.)**	
3588:2	18-26103	
ASD-TDR–	**(Non-AEC)**	
63-90(Vol.II)	18-25972	
63-605(Pt.II)	18-25973	
AWRE-Lib–	**(British)**	
Bib/8	18-25263	Dep.(mc); $1.60(fs), $0.80(mf) OTS
AWRE-O–	**(British)**	
4/64	18-25879	Dep.(mc)
17/62	18-25706	
25/64	18-25921	Dep.(mc)
54/57	18-25467	
56/57	18-25315	
66/63	18-26497	
AWRE-Trans–	**(British)**	
43	18-25331	Dep.(mc); $1.10(fs), $0.80(mf) JCL
BAW–	**(Misc.)**	
1228	18-26825	Dep.(mc); $4.60(fs), $1.52(mf) OTS
BLG–	**(Belgian)**	
44	18-25039	Dep.(mc)
BM-RI–	**(Misc.)**	
6444	18-25316	Free(Bureau of Mines)
6455	18-26104	Free(Bureau of Mines)
BMI-X–		
294	18-25940	Dep.(mc); $3.60(fs), $1.34(mf) OTS
BNL–		
837	18-26260	Dep.; $5.50(OTS)
845	18-25468	Dep.; $0.50(OTS)
853	18-26974	Dep.; $0.50(OTS)
7096	18-25555	Discussions Faraday Soc., No. 36: 95-101(1963)
7405	18-26513	Nucl. Sci. Eng., 19: 221-9(1964)
7711	18-26641	Phys. Rev., 134: B1200-4(1964)
7740	18-26649	Phys. Rev., 134: B1269-80(1964)
7762	18-26648	Phys. Rev., 134: B1262-9(1964)
7771	18-26647	Phys. Rev., 134: B1248-62(1964)
7831	18-26334	Phys. Rev., 134: B1339-40(1964)
7979	18-26070	Dep.(mc); $18.00(fs), $8.69(mf) OTS
7983	18-26528	Dep.(mc); $1.10(fs), $0.80(mf) OTS
8006	18-25738	Dep.(mc); $1.60(fs), $0.80(mf) OTS
8020	18-26529	Dep.(mc); $1.10(fs), $0.80(mf) OTS
8028	18-26530	Dep.(mc); $3.60(fs), $1.16(mf) OTS
8083	18-25778	Dep.(mc); $5.60(fs), $1.91(mf) OTS
BSD-TDR–	**(Non-AEC)**	
64-34	18-26689	$1.60(OTS)
64-35	18-26252	$2.60(OTS)
CAPE–		
916	18-25852	EM
1077	18-25648	EM
CEA-R–	**(French)**	
2421	18-26105	Dep.(mc)
CEC–	**(Italian)**	
85	18-26814	For translation see ORNL-tr-80
CEI–	**(Canadian)**	
18	18-25603	Dep.; $0.50(AECL)
CERN–	**(European Organization for Nuclear Research)**	
64-23	18-26167	Dep.(mc)
CEX–		
63.7	18-25722	Health Phys., 10: 89-150(1964)
CISE–	**(Italian)**	
99	18-25639	Dep.(mc)
CLM–	**(British)**	
P34	18-26730	J. Nucl. Energy, Pt. C, 6: 237-50(1964)

Report No.	Abstract No.	Availability
P36	18-26744	Phys. Fluids, 7: 767-73(1964)
CNLM–	**(Misc.)**	
4016	18-25264	Dep.(mc); $1.10(fs), $0.80(mf) OTS
CONF-67–	**(Health Physics Society 8th Annual Meeting, New York, June 1963)**	
30	18-25722	See CEX-63.7
CONF-81	**18-25575**	**(Conference on Basic Mechanisms in the Radiation Chemistry of Aqueous Media, Gatlinburg, Tenn., May 1963) Radiation Res., Suppl. 4: 1-223(1964)**
CONF-114–	**(The International Conference on High Energy Accelerators, Dubna, U.S.S.R., Aug. 1963)**	
27	18-26170	See UCRL-10869
CONF-133	**18-26873**	**(International Atomic Energy Agency Symposium of Exponential and Critical Experiments with Calculations, Amsterdam, Sept. 1963) See STI/PUB/79(Vol.I)**
	18-26881	**See STI/PUB/79(Vol.II)**
CONF-176	**18-26460**	**(Cryogenic Engineering Conference, Boulder, Colo., Aug. 1963) Advan. Cryog. Eng., 9: 1-580(1964)**
CONF-182–	**(9th Scintillation and Semiconductor Counter Symposium, Washington, D. C., Feb. 1963)**	
15	18-25779	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-64-008-15
16	18-25739	Dep.(mc); $1.60(fs), $0.80(mf) OTS
CONF-354–	**(Accelerator Conference, Boston, Mass., Nov. 1963)**	
6	18-26684	ORINS. Gmelin, AED-CONF-63-221-7
CONF-364–	**(16th Annual Gaseous Electronics Conference, Pittsburgh, Oct. 1963)**	
9	18-26164	ORINS. Gmelin, AED-CONF-63-195-11
CONF-401–	**(Institute of Electrical and Electronics Engineers 1964 International Convention, New York, Mar. 1964)**	
2	18-26168	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-64-015-3
CONF-405–	**(4th Rare Earth Research Conference, Phoenix, Ariz., Apr. 1964)**	
19	18-25445	ORINS
20	18-26163	ORINS
21	18-25599	ORINS
30	18-25446	ORINS
31	18-25317	Dep.(mc); $1.60(fs), $0.80(mf) OTS
39	18-25318	Dep.(mc); $1.10(fs), $0.80(mf) OTS
CONF-481–	**(American Physical Society Annual Meeting, New York, Jan. 1964)**	
5	18-26531	See LADC-6007
56	18-26685	ORINS. Gmelin, AED-CONF-64-003-58
CONF-502–	**(International Congress of Nuclear Physics, Paris, July 1964)**	
9	18-26529	See BNL-8020
11	18-26528	See BNL-7983
12	18-26558	See UCRL-11377
CONF-504–	**(American Power Conference 26th Annual Meeting, Chicago, Apr. 1964)**	
4	18-26949	ORINS
5	18-26950	ORINS
6	18-26829	ORINS
CONF-524–	**(American Institute of Mining, Metallurgical and Petroleum Engineers Annual Meeting, New York, Feb. 1964)**	
1	18-25908	ORINS. Gmelin, AED-CONF-64-006-6
2	18-26065	ORINS. Gmelin, AED-CONF-64-006-5
CONF-525–	**(6th International Mineral Processing Congress, Cannes, France, May 26–June 2, 1963)**	
1	18-25327	See RT/GEO(64)-1
CONF-526–	**(Libby/Cockcroft US/UK Meeting on Graphite Chemistry, Richland, Wash., May 1964)**	
1	18-25321	See GA-5215
CONF-532–	**(Symposium on Thermal Radiation of Solids, San Francisco, Mar. 1964)**	
1	18-26097	ORINS. Gmelin, AED-CONF-64-018-1
CONF-533–	**(3rd Conference on Exploding Wires, Boston, Mar. 1964)**	
1	18-26809	ORINS. Gmelin, AED-CONF-64-012-2
COO–		
1140-103	18-25319	Dep.(mc); $23.50(fs), $14.75(mf) OTS
1148-84	18-25320	Dep.(mc); $3.60(fs), $1.24(mf) OTS
CPP–	**(Misc.)**	
29	18-25603	See CEI-18
CRC–	**(Canadian)**	
487	18-25604	Dep.; $1.50(AECL)
CVNA–	**(Misc.)**	
134	18-26863	Dep.(mc); $13.50(fs), $6.17(mf) OTS
D–	**(Misc.)**	
1-82-0217	18-26690	
1-82-0306	18-26106	
DESY–	**(German)**	
64/6	18-26276	Dep.(mc)
DLCS–		
5000364	18-26915	Dep.(mc); $4.60(fs), $1.64(mf) OTS
5000464	18-26916	Dep.(mc); $3.60(fs), $1.37(mf) OTS
DM–	**(Misc.)**	
72	18-26917	Dep.; $1.00(AECL)
DMIC–	**(Non-AEC)**	
197	18-25941	$2.75(OTS)
DP–		
882	18-25605	Dep.; $0.75(OTS)
DRCL–	**(Canadian)**	
412A	18-26817	Can. J. Phys., 42: 957-71(1964)
EANDC(UK)–	**(European-American Nuclear Data Committee)**	
25L	18-25740	Dep.(mc)
EANDC(US)–	**(European-American Nuclear Data Committee)**	
53	18-26559	See WASH-1047
EFINS–	**(Misc.)**	
63-74	18-26406	J. Math. Phys. (N. Y.), 5: 769-74(1964)
ERR-AN–	**(Non-AEC)**	
336	18-25633	
ERR-FW–	**(Non-AEC)**	
210	18-26107	

Report No.	Abstract No.	Availability
EUR–	**(European Atomic Energy Community)**	
505.e	18-25887	Simon Stevin. Wis- Natuurk. Tijdschr., 36: 122-30(1963)
548.f	18-26864	Dep.(mc)
1802.d	18-26918	Dep.(mc)
1803.i	18-26919	Dep.(mc)
1804.f	18-26920	Dep.(mc)
1810.i	18-26921	Dep.(mc)
EURAEC–		
1037	18-25974	Dep.(mc); $7.60(fs), $2.33(mf) OTS
1038	18-25922	Dep.(mc); $4.60(fs), $1.64(mf) OTS
1039	18-25945	Dep.(mc); $1.10(fs), $0.80(mf) OTS
1055	18-26925	See GEAP-4423
1065	18-26924	Dep.(mc); $8.60(fs), $3.17(mf) OTS
1070	18-25657	Dep.(mc); $2.60(fs), $0.98(mf) OTS
FTD-TT–	**(Non-AEC)**	
63-1046	18-25095	OTS
64-400	18-26711	OTS
GA–	**(Misc.)**	
4677	18-26253	$3.60(OTS)
5215	18-25321	Dep.(mc); $1.60(fs), $0.80(mf) OTS
GAMD–	**(Misc.)**	
891(Rev.1)	18-25322	Dep.(mc); $1.10(fs), $0.80(mf) OTS
GD-A–	**(Non-AEC)**	
63-0968	18-25633	See ERR-AN-336
GEAP–	**(Misc.)**	
4423	18-26925	Dep.(mc); $8.60(fs), $3.11(mf) OTS
4556	18-25942	Dep.(mc); $6.60(fs), $2.18(mf) OTS
4604	18-25780	Dep.(mc); $2.60(fs), $0.83(mf) OTS
HASL–		
143	18-25265	Dep.; $1.00(OTS)
HW–		
28529	18-25266	Dep.(mc); $2.60(fs), $0.86(mf) OTS
30116	18-25943	Dep.(mc); $2.60(fs), $0.86(mf) OTS
48782	18-25323	Dep.(mc); $1.10(fs), $0.80(mf) OTS
50086	18-26899	Dep.(mc); $1.10(fs), $0.80(mf) OTS
65268(Rev.1)	18-25707	Dep.(mc); $7.60(fs), $2.36(mf) OTS
68600-38	18-26981	Dep.; $0.50(OTS)
72335(Pt.2)	18-26975	Dep.; $2.00(OTS)
77962	18-25708	Dep.(mc); $2.60(fs), $0.89(mf) OTS
80523(Rev.1)	18-26900	Dep.; $1.00(OTS)
80848	18-26976	Dep.(mc); $1.60(fs), $0.80(mf) OTS
81088	18-26955	Dep.(mc); $1.60(fs), $0.80(mf) OTS
HW-SA–		
3059	18-26870	Nucl. Sci. Eng., 19: 196-202(1964)
IDO–		
14620	18-26977	Dep.; $5.00(OTS)
IPPJ–	**(Japanese)**	
23	18-26691	Dep.(mc)
IPST-Cat.–	**(Russian)**	
683	18-25868	See OTS-63-11008
684	18-25868	See OTS-63-11008
832	18-25868	See OTS-63-11008
IS–		
555	18-25411	Phys. Rev., 135: A144-8(1964)
659	18-26018	J. Electrochem. Soc., 111: 712-16(1964)
664	18-25384	J. Inorg. Nucl. Chem., 26: 643-53(1964)
671	18-25383	J. Inorg. Nucl. Chem., 26: 635-41(1964)
708	18-26020	J. Electrochem. Soc., 111: 720-1(1964)
724	18-26280	Ann. Phys. (N. Y.), 27: 362-76(1964)
725	18-26019	J. Electrochem. Soc., 111: 717-19(1964)
735	18-25393	J. Inorg. Nucl. Chem., 26: 825-36(1964)
753	18-26279	Ann. Phys. (N. Y.), 27: 338-61(1964)
784	18-25614	Anal. Chem., 36: 1222-9(1964)
820	18-25280	Anal. Chem., 36: 1324-6(1964)
834	18-25278	Anal. Chem., 36: 1287-9(1964)
839	18-26108	Dep.; $2.50(OTS)
JNPC-NFISG–	**(English)**	
P8	18-25777	See AEEW-M-395
JPRS–	**(Non-AEC)**	
23767	18-26990	$2.25(OTS)
24896	18-25096	$0.50(OTS)
24936	18-25097	$0.50(OTS)
K–		
1521	18-25267	Dep.; $0.50(OTS)
1609	18-25324	Dep.; $0.50(OTS)
KFK-tr–	**(German)**	
139	18-26963	Dep.(mc); $1.60(fs), $0.80(mf) JCL
LA–		
2687	18-26109	Dep.; $9.10(fs), $3.38(mf) OTS
LADC–		
5843	18-25667	Phys. Fluids, 7: 327-34(1964)
5892	18-26039	Phys. Rev., 135: A176-80(1964)
6007	18-26531	Dep.(mc); $4.60(fs), $1.58(mf) OTS; Gmelin, AED-CONF-64-003-47
6210	18-26137	Phys. Fluids, 7: 908-10(1964)
6438	18-26110	Dep.(mc); $8.10(fs), $2.63(mf) OTS
MATT–		
210	18-26745	Phys. Fluids, 7: 773-7(1964)
230	18-26756	Phys. Fluids, 7: 917-18(1964)
ML-TDR–	**(Non-AEC)**	
64-36	18-25268	
MLM–		
1154	18-25870	Dep.; $0.50(OTS)
1161	18-25325	Dep.; $1.25(OTS)
MTI–	**(Misc.)**	
63TR52	18-25640	See TID-20632
MTP-ASTR–	**(Non-AEC)**	
A-63-8	18-26956	$1.60(fs), $0.80(mf) OTS
N–	**(Misc.)**	
63-14743	18-25896	See PF-63-3
63-14854	18-25944	
64-12666	18-26250	See AD-423086
64-12926	18-26107	See ERR-FW-210
64-13057	18-26188	See SUI-63-37
64-13063	18-26956	See MTP-ASTR-A-63-8
64-13153	18-25741	
64-13187	18-26067	See AI-8971
NAA-SR–		
8414	18-26957	Dep.; $1.75(OTS)
9418	18-26532	Dep.(mc); $4.60(fs), $1.52(mf) OTS
NAA-SR-Memo–		
9383	18-25326	Dep.(mc); $3.60(fs), $1.13(mf) OTS
NAEC-AML–	**(Non-AEC)**	

Report No.	Abstract No.	Availability
1909	18-25975	
NAS-NRC–	**(Non-AEC)**	
Pub-1184	18-25781	$5.00(NAS)
NASA-CR–	**(Non-AEC)**	
54043	18-25314	See AI-64-75
55187	18-26188	See SUI-63-37
55217	18-26067	See AI-8971
NASA-TM–	**(Non-AEC)**	
X-51372	18-26956	See MTP-ASTR-A-63-8
NASA-TN–	**(Misc.)**	
D-2145	18-26203	$1.50(OTS)
D-2329	18-26071	$0.50(OTS)
NDL-TR–	**(Non-AEC)**	
49	18-25709	
NLCO–		
905	18-25269	Dep.; $1.75(OTS)
NMI–	**(Misc.)**	
1261	18-25976	Dep.(mc); $3.60(fs), $1.22(mf) OTS
2128	18-25894	Dep.(mc); $5.60(fs), $1.88(mf) OTS
NP–	**(AEC File No. for Non-AEC Reports)**	
12562	18-26958	Dep.(mc)
13958	18-26386	Dep.(mc)
13973	18-26169	Dep.(mc)
13974	18-26533	Dep.(mc)
13981	18-25687	Dep.(mc)
13984	18-25710	Dep.(mc)
13985	18-25055	Dep.(mc)
13990	18-26111	
14011	18-26692	
14017	18-26112	Dep.(mc)
NP-tr–	**(AEC File No. for Non-AEC Translations)**	
1247	18-25987	Dep.(mc); $1.60(fs), $0.80(mf) JCL
NRC–	**(Canadian)**	
7822	18-26206	Can. J. Phys., 42: 886-905(1964)
NRL–	**(Misc.)**	
6054	18-26098	Dep.(mc); $1.00(OTS)
NUMEC–		
2389-2	18-26901	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2389-3	18-25895	Dep.(mc); $1.10(fs), $0.80(mf) OTS
NYO–		
2462-1	18-26982	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2568-1	18-25084	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2734-1	18-26983	Dep.(mc); $7.60(fs), $2.60(mf) OTS
2930-2	18-25656	Dep.(mc); $8.10(fs), $2.72(mf) OTS
3114-1	18-25657	Dep.(mc); $2.60(fs), $0.98(mf) OTS
10405	18-25259	Dep.; $1.75(OTS)
10726	18-25270	Dep.; $0.50(OTS)
ORNL–		
3400	18-25877	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3441	18-25711	Dep.; $2.75(OTS)
3572	18-26962	Dep.; $4.50(OTS)
3582	18-26113	Dep.; $2.75(OTS)
3585	18-25606	Dep.; $1.00(OTS)
3633	18-25607	Dep.; $3.00(OTS)
ORNL-IIC–		
2	18-25876	Dep.; Free(ORNL)

Report No.	Abstract No.	Availability
ORNL-TM–		
857	18-26978	Dep.(mc); $3.60(fs), $1.34(mf) OTS
867	18-25608	Dep.(mc); $1.60(fs), $0.80(mf) OTS
875	18-26556	Dep.(mc); $1.10(fs), $0.80(mf) OTS
ORNL-tr–		
80	18-26814	Dep.(mc); $1.60(fs), $0.80(mf) JCL
128	18-25612	Dep.(mc); $1.60(fs), $0.80(mf) JCL
OTS–	**(Misc.)**	
63-11008	18-25868	$0.50(OTS)
64-21840	18-26990	See JPRS-23767
64-31389	18-25096	See JPRS-24896
64-31409	18-25097	See JPRS-24936
PAN–	**(Polish)**	
280	18-26498	Dep.
459/XVI	18-25750	Dep.
481/I	18-26557	Dep.
PATENTS	**(British)**	**3s. 6d. each, U. K. Patent Office**
948,130	18-25637	
950,732	18-26951	
955,117	18-25447	
957,707	18-26835	
957,720	18-25638	
957,730	18-25672	
957,737	18-25764	
957,738	18-25649	
957,754	18-26952	
957,786	18-26836	
957,789	18-26887	
957,791	18-26972	
957,814	18-26837	
957,815	18-26838	
957,816	18-25909	
957,863	18-26182	
957,955	18-26888	
958,011	18-26839	
958,088	18-26889	
958,159	18-25765	
958,169	18-25766	
958,214	18-25650	
958,267	18-25956	
958,376	18-25957	
958,439	18-26840	
958,446	18-26907	
958,598	18-25651	
958,620	18-25910	
958,629	18-26890	
958,650	18-26841	
958,684	18-26908	
958,697	18-26909	
958,717	18-25911	
958,790	18-25958	
958,801	18-25652	
958,812	18-25736	
958,820	18-25912	
958,840	18-25673	
958,887	18-26842	
958,903	18-26910	
958,921	18-26843	
958,954	18-26844	
958,974	18-25653	
959,189	18-25913	
959,383	18-26845	
959,386	18-26911	
959,470	18-26912	
959,537	18-26891	
959,574	18-25262	
959,599	18-26846	

Report No.	Abstract No.	Availability
959,696	18-25767	
959,751	18-26980	
959,852	18-26847	
960,007	18-25737	
960,019	18-26848	
960,027	18-26066	
960,078	18-25681	
960,079	18-25654	
960,104	18-25959	
960,170	18-26849	
960,226	18-25856	
960,325	18-26810	
960,346	18-25914	
960,349	18-26913	
960,352	18-25960	
960,373	18-25768	
960,408	18-25311	
960,457	18-25625	
960,548	18-25857	
960,618	18-25312	
960,619	18-25313	
960,652	18-25626	
960,673	18-26850	
960,678	18-26953	
PATENTS	**(German)**	
1,162,002	18-25258	
1,162,006	18-26851	
1,162,494	18-25858	
1,163,305	18-25627	
1,163,464	18-26852	
1,163,466	18-26853	
1,163,788	18-25448	
1,163,989	18-25859	
1,164,583	18-26183	
1,164,994	18-25915	
1,165,171	18-26854	
1,165,172	18-26954	
PATENTS	**(U. S.)**	
3,129,591	18-26184	
3,132,046	18-26496	
3,132,248	18-25769	
3,132,249	18-25853	
3,132,251	18-25600	
3,134,650	18-25628	
3,134,651	18-25629	
3,134,722	18-26961	
3,134,898	18-25770	
3,134,899	18-25771	
3,134,901	18-25854	
3,134,903	18-26994	
3,134,904	18-25703	
3,135,419	18-26995	
3,135,599	18-25916	
3,135,856	18-25961	
3,135,863	18-26185	
3,136,051	18-25962	
3,136,432	18-26855	
3,136,593	18-26996	
3,136,599	18-25630	
3,136,600	18-25631	
3,136,629	18-25963	
3,136,697	18-26973	
3,136,698	18-26856	
3,136,699	18-26892	
3,136,700	18-26857	
3,136,701	18-26858	
3,136,715	18-25632	
3,136,883	18-25964	
3,136,888	18-25772	
3,136,889	18-25855	
3,136,891	18-26859	
3,136,892	18-25773	
3,136,902	18-25774	
3,136,908	18-26186	
3,136,915	18-26811	
3,136,948	18-26997	
3,137,174	18-26998	
3,137,397	18-26860	
3,137,551	18-26999	
3,137,572	18-25917	
3,137,634	18-26861	
3,137,657	18-25965	
3,138,453	18-25918	
3,138,535	18-26862	
3,138,652	18-27000	
3,139,360	18-27001	
PATENTS	**(U.S.S.R.)**	
159,900	18-25655	
160,024	18-25775	
160,236	18-25601	
PF–	**(Non-AEC)**	
63-3	18-25896	
R–	**(Misc.)**	
1829	18-25039	See BLG-44
RCC-M–	**(British)**	
173	18-25609	Dep.; $0.20(BIS); 1s. 2d. (HMSO)
RISÖ–	**(Danish)**	
73	18-26499	Dep.(mc)
76	18-26693	Dep.(mc)
RR-TR–	**(Non-AEC)**	
63-22	18-26250	See AD-423086
RSIC–	**(Non-AEC)**	
177	18-25946	OTS
RT-GEO–	**(Italian)**	
(64)-1	18-25327	Dep.(mc)
RTI-ING–	**(Italian)**	
(63)-4	18-26959	Dep.(mc)
SC-DC–		
64-864	18-25328	Dep.(mc); $7.60(fs), $2.82(mf) OTS
SCL-TM–		
64-53	18-26115	Dep.(mc); $2.60(fs), $0.89(mf) OTS
SGAE-BL–	**(Austrian)**	
5/1964	18-25085	Dep.(mc)
SGAE-CH–	**(Austrian)**	
4/1964	18-25610	Dep.(mc)
SGAE-IB–	**(Austrian)**	
IA-1/1964	18-25871	Dep.(mc)
IA-2/1964	18-25234	Dep.(mc)
SGAE-ME–	**(Austrian)**	
1/1964	18-25983	Dep.(mc)
SIT–		
105	18-26755	Phys. Fluids, 7: 915-17(1964)
SRIA–		

Report No.	Abstract No.	Availability
120	18-25469	Dep.; $1.00(OTS)
STI-DOC–	**(International Atomic Energy Agency)**	
10/27	18-26979	$3.00; Sch 63,-; 18s.stg; F.fr.12,-; DM 10.50 IAEA.
STI-PUB–	**(International Atomic Energy Agency)**	
79(Vol.I)	18-26873	$10.00; Sch 210,-; 60s.stg; F.fr. 40,-; DM 35,- (IAEA)
79(Vol.II)	18-26881	$12.00; Sch 252,-; 72s.stg; F.fr 48,-; DM 42.- (IAEA)
SUI–	**(Misc.)**	
63-37	18-26188	$3.60(fs), $1.37(mf) OTS
TEI–		
826	18-26984	Dep.(mc); $1.60(fs), $0.80(mf) OTS
839	18-25684	Dep.(mc); $10.50(fs), $4.25(mf) OTS
845	18-26985	Dep.(mc); $1.60(fs), $0.80(mf) OTS
846	18-26986	Dep.(mc); $1.60(fs), $0.80(mf) OTS
TID–		
4100(Suppl. 21)	18-26987	Dep.; Free(DTI Extension)
7015(Indexes) (Rev.1)	18-25271	Dep.; $2.50(OTS)
19965	18-25669	Phys. Fluids, 7: 907-8(1964)
20154	18-25185	Radiation Res., 22: 264-75(1964)
20171	18-26217	Phys. Rev., 135: A36-9(1964)
20229	18-25560	J. Chem. Phys., 40: 2999-3007(1964)
20247	18-25561	J. Chem. Phys., 40: 3007-14(1964)
20492	18-25452	J. Am. Chem. Soc., 86: 2076-7(1964)
20605	18-26926	Dep.(mc); $8.10(fs), $2.84(mf) OTS
20632	18-25640	Dep.(mc); $4.60(fs), $1.58(mf) OTS
20635	18-26988	Dep.(mc); $1.60(fs), $0.80(mf) OTS
20636	18-25086	Dep.(mc); $1.10(fs), $0.80(mf) OTS
20638	18-25688	Dep.(mc); $3.60(fs), $1.40(mf) OTS
20639	18-25984	Dep.(mc); $8.60(fs), $3.17(mf) OTS
20641	18-25087	Dep.(mc); $3.60(fs), $1.16(mf) OTS
20645	18-25329	Dep.(mc); $1.10(fs), $0.80(mf) OTS
20646	18-25828	Dep.(mc); $1.60(fs), $0.83(mf) OTS
20647	18-26927	Dep.(mc); $2.60(fs), $0.89(mf) OTS
20648	18-25680	Dep.(mc); $3.60(fs), $1.37(mf) OTS
UCD–		
472-109	18-25088	Dep.; $2.75(OTS)
UCRL–		
7625-T	18-25362	J. Chem. Phys., 40: 2932-7(1964)
10827	18-25583	Radiation Res., Suppl. 4: 158-74(1964)
10869	18-26170	Dep.(mc); $1.60(fs), $0.80(mf) OTS
11042	18-25370	J. Chem. Phys., 40: 3123-4(1964)
11084	18-26210	J. Chem. Phys., 40: 2851-9(1964)
11105	18-26340	Phys. Rev., 134: B1372-6(1964)
11137	18-26328	Phys. Rev., 134: B1289-94(1964)
11158	18-26469	Appl. Phys. Letters, 4: 75-7(1964)
11162	18-26336	Phys. Rev., 134: B1358-64(1964)
11244	18-26343	Phys. Rev., 134: B1393-5(1964)
11298	18-26485	Phys. Rev., 135: A10-16(1964)
11356	18-26762	Phys. Rev. Letters, 12: 639-40(1964)
11371	18-26346	Phys. Rev. Letters, 12: 621-5(1964)
11377	18-26558	Dep.(mc); $1.10(fs), $0.80(mf) OTS
11452	18-26591	Nucl. Phys., 50: 177-201(1964)
UCRL-Trans–		
1044(L)	18-25332	Dep.(mc); $1.60(fs), $0.80(mf) JCL
UR–		
645	18-25057	Dep.; $1.10(fs), $0.80(mf) OTS
USNRDL-TR–	**(Non-AEC)**	
722	18-25712	$5.60(OTS)
VDDIT–	**(Swedish)**	
16(4.2)	18-26072	Dep.(mc)
89	18-25713	Dep.(mc)
90	18-25272	Dep.(mc)
WADD-TR–	**(Non-AEC)**	
60-132(Pt.III)	18-25985	
60-581(Pt.IV)	18-25986	
61-72(Vol.XIX)	18-26116	$1.25(OTS)
WAPD–	**(Misc.)**	
246	18-26073	Dep.; $2.75(OTS)
WAPD-T–		
1593	18-26512	Nucl. Sci. Eng., 19: 209-14(1964)
1613	18-26516	Nucl. Sci. Eng., 19: 248-9(1964)
WASH–		
1047	18-26559	Dep.; $2.00(OTS)
WCAP–	**(Misc.)**	
2294	18-26928	Dep.(mc); $5.60(fs), $1.91(mf) OTS
Y–		
1470-C	18-25330	Dep.; $2.50(OTS)
1470-D	18-25449	Dep.; $2.75(OTS)

DEPOSITORIES OF USAEC REPORTS

DEPOSITORIES OF USAEC REPORTS

In Countries Other Than the U. S.

ARGENTINA
Buenos Aires, Comisión Nacional de Energía Atómica
AUSTRALIA
Canberra, Australian National Library
Sutherland, New South Wales, Australian Atomic Energy Commission
AUSTRIA
Vienna, Zentral Bibliothek der Physikalischen Institute der Universität
BELGIUM
Mol-Donk, Centre d'Etude de l'Energie Nucleaire
BOLIVIA
La Paz, Comisión Nacional de Energiá Nuclear
BRAZIL
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao
São Paulo, Instituto de Energia Atomica, Cidade Universitaria São Paulo
BURMA
Rangoon, Union of Burma Applied Research Institute, Atomic Energy Center Library
CANADA
Hamilton, McMaster University
Ottawa, National Research Council Library
Vancouver, University of British Columbia
CEYLON
Colombo, University of Ceylon
CHILE
Santiago, Instituto de Fisica y Matematicas, Universidad de Chile
CHINA
Hsinchu, Taiwan, Free China, National Tsing Hua University
COLOMBIA
Bogota, Instituto De Asuntos Nucleares
COSTA RICA
San Pedro, University of Costa Rica Library
DENMARK
Risö, Danish Atomic Energy Commission
DOMINICAN REPUBLIC
Santo Domingo, Comisión Nacional de Asuntos Nucleares
ECUADOR
Quito, Escuela Politécnica Nacional
EL SALVADOR
San Salvador, Universidad de El Salvador, Biblioteca de Energia Nuclear
ENGLAND
Birmingham, Central Library
Bristol, Central Library
Kingston upon Hull, Central Library
Leeds, Central Library
Liverpool, Central Library
London, Central Library, Acton
London, Science Museum Library, South Kensington
Manchester, Central Library
Newcastle upon Tyne, Central Library
ENGLAND (CONT.)
Nottingham, Central Library
Sheffield, Central Library
FINLAND
Helsinki, Teknillisen Korkeakoulun Kirjasto
FRANCE
Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
Paris, Académie des Sciences
GERMANY
Berlin, Hahn-Meitner-Institut für Kernforschung Berlin
Frankfurt/Main, Gmelin-Institut
Munich, Technische Hochschule, Bibliothek
GHANA
Accra, University College of Ghana
GREECE
Athens, Nuclear Research Center "Democritus"
GUATEMALA
Guatemala, Comisión Nacional de Energía Nuclear
HAITI
Port au Prince, University of Haiti
HONDURAS
Tegucigalpa, Comisión Hondureña de Energía Atómica
ICELAND
Reykjavik, University of Iceland, Atomic Energy Library
INDIA
Bombay, Department of Atomic Energy
INDONESIA
Bandung, Java, Bandung Institute of Technology
Djogjakarta, Java, Science Faculty, Gadjah Mada University
IRAN
Tehran, Tehran University Center for Nuclear Studies
IRAQ
Baghdad, Iraqi Atomic Energy Commission
IRELAND
Dublin, University College
ISRAEL
Rehovoth, Israel Atomic Energy Commission
ITALY
Rome, Centro di Studi Nucleari della Casaccia
Rome, Comitato Nazionale per l'Energia Nucleare
JAPAN
Tokyo, National Diet Library
KOREA
Seoul, Office of Atomic Energy
LEBANON
Beirut, Lebanese National Council for Scientific Research
LUXEMBOURG
Luxembourg, Ministry of Transport and Electricity
MALAYSIA
Kuala Lumpur, University of Malaysia
MEXICO
Mexico, D.F., Comisión Nacional de Energía Nuclear
NETHERLANDS
The Hague, Reactor Centrum Nederland
NEW ZEALAND
Wellington, Department of Scientific and Industrial Research
NIGERIA
Ibadan, University of Ibadan
NORTHERN IRELAND
Belfast, City Library
NORWAY
Lillestrom, Institutt for Atomenergi
PAKISTAN
Lahore, West Pakistan, Atomic Energy Centre
PERU
Lima, Junta de Control de Energia Atomica
PHILIPPINE REPUBLIC
Manila, Philippine Atomic Energy Commission
POLAND
Warsaw, Biura Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej
PORTUGAL
Sacavem, Junta de Energía Nuclear
REPUBLIC OF SOUTH AFRICA
Pretoria, Atomic Energy Board Library
REPUBLIC OF THE CONGO
Leopoldville, Université Lovanium
SCOTLAND
Glasgow, Mitchell Library
SPAIN
Madrid, Junta de Energía Nuclear, Biblioteca Documentación y Publicaciones, Ciudad Universitaria
SWEDEN
Nyköping, Aktiebolaget Atomenergi
SWITZERLAND
Zurich, Institut für Physik, Eidg. Technische Hochschule
THAILAND
Bangkok, Office of the Thai Atomic Energy Commission, Department of Science
TURKEY
Ankara, Turkish Atomic Energy Commission, Atomic Energy Library
UNITED ARAB REPUBLIC
Cairo, Atomic Energy Commission
URUGUAY
Montevideo, Comision Nacional de Energia Atomica
VENEZUELA
Caracas, Instituto Venezolano de Investigaciones Científicas
VIET-NAM
Dalat, Institute of Nuclear Research, Atomic Energy Office
YUGOSLAVIA
Belgrade, Federal Commission for Nuclear Energy

In International Agencies

AUSTRIA
Vienna, International Atomic Energy Agency
BELGIUM
Brussels, La Bibliotheque EURATOM
FRANCE
Paris, European Nuclear Energy Agency, O.E.C.D.
ITALY
Ispra, EURATOM Research Center
SWITZERLAND
Geneva, United Nations Library

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON, D.C. 20402

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300

MIAMI UNIVERSITY LIBRARY